Industrial Mechanic / Millwright Study Notes and Review

"Questions and Answers", and various useful notes, to help you study for the Interprovincial Examination for Industrial / Millwright / Industrial Mechanic. It is also a great resource for your shipboard engineering knowledge.

Section Description:

1. **Hoisting and Rigging**
2. **Determining Load Weights**
3. **Installation of Wire Rope Clips**
4. **Hydraulics and Pumps**
5. **Bearings**
6. **Cleaning & Inspection of Bearings**
7. **Pneumatics & Compressors**
8. **Conveyors**
9. **Drives**
10. **Drive Formula's**
11. **Rules for Gearing Calculations**
12. **Roller Chain Speed**
13. **Chain Definitions**
14. **Standard Roller Chain Numbers**
15. **Metallurgy**
16. **Lubrication**
17. **Fabrication**
18. **Welding**
19. **Gauge - - - - Sheet Metal**
20. **Hand Tools**
21. **Power Tools**
22. **Standard Tapers**
23. **Thread Terminology**
24. **Screw Thread Classes to Fit**
25. **Keys**
26. **Layout**
27. **Formula For Cement**
28. **Basic Steps Of Lifting And Handeling**
29. **Metric System**
30. **Combination Set**
31. **Multipliers That Are Usefull To The Trade**

RIGGING

1. THE "LAY" OF THE ROPE MEANS THE
ANS. DIRECTION THE WIRES AND STRANDS ROTATE

2. DEFECTIVE RIGGING COMPONENTS SHOULD BE
ANS. DESTROYED

3. INSPECTION OF RIGGING EQUIPMENT SHOULD BE MADE
ANS. AS OFTEN AS NECESSARY FOR SAFE OPERATION

4. THE MINIMUM ECCEPTABLE FACTOR OF SAFETY FOR WIRE ROPE IS
ANS. 5.1

5. A GOOD RULE OF THUMB FOR CALCULATING THE SAFE WORKING LOAD (S.W.L.) FOR WIRE ROPE IS
ANS. DIA. X DIA. X 8 = TONS

6. THE DIAMETER OF A WIRE ROPE IS MEASURED BY THE
ANS. DIAMETER OF THE CIRCLE THAT CAN ENCLOSE ALL STRANDS

7. IF A WIRE ROPE HAS A CATALOUGE BREAKING STRENGTH OF 10.4 TONS, THE MAX. WORKING LOAD IS
ANS. 2.08

8. THE SAFE WORKING LOAD FOR A ½" DIA. STEEL WIRE ROPE IS
ANS. 2 TONS

9. BEFORE YOU MOVE AN OBJECT, YOU NEED TO KNOW ITS
ANS. WEIGHT

10. PULLEYS IN A BLOCK ARE CALLED
ANS. SHEAVES

11. WHAT MUST YOU KNOW ABOUT A ROPE TO PREVENT OVERLOADING
ANS. ITS BREAKING STRENGTH, THE SAFETY FACTOR AND ITS SAFE WORKING LOAD

12. WHICH TYPEE OF SPLICE INCREASES THE ROPE'S DIAMETER
ANS. SHORT SPLICE

13. A TEMPORARY FASTENING OF A ROPE TO A RING, POLE OR HOOK IS CALLED
ANS. HITCH

14. THE BRIDGE CRANE AND THE HALF GANTRY CRANE ARE VARIATIONS OF THE
ANS. GANTRY CRANE

15. WHAT TERM DIFINES THE LENGTH OF A CHAIN SLING
ANS. REACH

16. THE CAPACITY OF SLINGS IS EXPRESSED IN
ANS. POUNDS

17. THE SLING TIGHTENS ON THE LOAD AS STRAIN IS PUT ON IT IN WHICH SLING HITCH
ANS. CHOKER

18. MANILLA ROPE IS MADE FROM WHICH OF THE FOLLOWING MATERIALS
ANS. PLANT FIBRES

19. THE IDEAL MECHANICAL ADVANTAGE OF A SIMPLE TACKLE SYSTEM EQUALS THE NUMBER OF PARTS OF ROPES (OR FALLS)

ANS. AT THE MOVABLE BLOCK

20. WHEN COMPARED TO MANILLA SLINGS, SYNTHECTIC SLINGS ARE
ANS. STRONGER

21. WHAT SHOULD YOU LOOK FOR WHEN INSPECTING FIBRE ROPE SLINGS
ANS. DETERIORATION DUE TO EXPOSURE, BROKEN OR CUT FIBRE, AND PROPER SPLICING

22. WHEN USING CHAIN SLINGS, WHICH PRECAUTIONS SHOULD BE TAKEN
ANS. AVOID SUDDEN JERKS, AVOID TWISTING AND KINKS, AND PROTECT THE CHAIN FROM SHARP CORNERS.

23. WHAT IS MEANT BY WHIPPING?
ANS. FIXING THE END OF A ROPE SO THAT THE STRANDS WILL NOT UNRAVEL WHAT TYPE OF SPLICE IS USED TO FASTEN A ROPE TO A HOOK OR RING

24. WHAT TYPE OF SPLICE IS USED TO FASTEN A ROPE TO A HOOK OR RING
ANS. EYE

25. WHEN UNWINDING WIRE RIOE FRON A REEL BE SURE THET THE REEL
ANS. TURNS

26. WIRE ROPE THET HAS ITS STRANDS AND WIRES WOUND IN THE SAME DIRECTION
ANS. LANG LAY WIRE ROPE

27. WHEN INSTALLING "U" BOLT CLIPS ON A WIRE ROPE THE "U" OF THE CLIP SHOULD BEAR AGAINST THE
ANS. DEAD END OF THE WIRE ROPE

28. IF A "U" BOLT CLIP IS INSTALLED PROPERLY IT WILL PROVIDE WHAT PERCENTAGE OF THE WIRE ROPE STRENGTH
ANS. 80%

29. "U" BOLT CLIPS SHOULD BE SPACED APPROXIMATELY
ANS. 6 WIRE ROPE DIAMETERS APART

30. HOW FAR SHOULD THE BASE OF A STRAIGHT LADDER BE PLACED FROM THE SUPPORTING WALL
ANS. ¼ OF ITS WORKING LENGTH

31. MAKE SURE THAT SCAFFOLD PLANKING DOES NOT EXTEND MORE THAN ½ INCHES FROM CENTRE OF THE SUPPORT BUT DOES EXTEND AT LEAST
ANS. 6 INCHES BEYOND THE CENTRE OF SUPPORT

32. GUY WIRES GIVE THE MOST SUPPORT WHEN THAT ARE POSITIONED AT AN ANGLE FROM VERTICAL OF
ANS. 458

33. THE FASTENING OF ONE PART OF A ROPE TO ANOTHER PART OF THE SAME ROPE BY INTERLACING THEM AND DRAWING THE LOOPS TIGHT IS CALLED
ANS. KNOT

34. CRANE SIGNALS _ _ _ WHIP AND RAISE LOAD
ANS.
1. TOUCH THE ELBOW IF THE SIGNAL APPLIES TO THE RUNNER
2. HOIST – FORARM VERTICAL, MAKE SMALL HORIZONTAL CIRCLES

35. WHICH HAS MORE LIFTING CAPACITY – A CHOKER OR BASKET SLING
ANS. A CHOKER SLING HAS ABOUT 75% OF THE LIFTING CAPACITY OF A SINGLE SLING, WHILE A BASKET SLING HAS TWICE THE LIFTING CAPACITY

36. IDENTIFY 1. SQUARE KNOT, 2. TIMBER HITCH

ANS. KNOW YOUR KNOTS

37. REASON FOR CHOPPING OFF DEAD END CABLE FROM CRANE DRUM
ANS. SHORT ENDS OD WIRE WILL FLY AROUND, CREATING A HAZARD

38. SAFE LIFTING ANGLES USING CHAINS AND SLINGS
ANS. AS THE LEG ANGLES DECREASE FROM 908 DEGREES TO 308 THE SAFE WORKING LOAD DECREASES BY 50%

DETERMINING LOAD WEIGHTS

ONE OF THE MOST IMPORTANT STEPS IN ANY RIGGING OPERATION IS TO KNOW THE WEIGHT OF THE LOAD TO BE HOISTED.

IF THIS INFORMATION CANNOT BE OBTAINED FROM BLUEPRINTS, SHIPPING PAPERS OR FROM ANY SOURCE, IT MAY BE NECESSARY TO CALCULATE THE WEIGHT

EXAMPLE:

FIND THE VOLUME OF A RECTANGULAR STEEL PLATE, 6 FT. LONG AND 3 FT. WIDE AND 1 INCH THICK

6 FT. X 3FT. = 18 SQ. FT.

VOLUME = 18 SQ. FT. X 1/12 = 1.5 CU. FT.

STEEL PLATE IS 490 LBS. PER CU. FT.

OR

THE SINGLE WEIGHT IS 40.8 LBS., WHICH IS THE WEIGHT OF 1 SQ. FT. OF STEEL 1 INCH THICK WEIGHT IF STEEL PLATE IS 18 SQ. FT. X 40.8 = 734 LBS.

OR

40.8 LBS. IS TYE WEIGHT OF 1 SQ. FT. OF STEEL 1 INCH THICK

1/8 THICK BY 1 SQ. FT. WOULD WEIGH 40.8 48 = 5.1

THERE ARE 8, 1/8TH INCH 1 INCH THICK.

RULE OF THUMB - SAFE WORKING LOADS OF THE MOST COMMON WIRE ROPE USED TO COMPUTE IN TONS

SWL = ROPE DIAMETER X ROPE DIAMETER X 8

EXAMPLES:

A) ½ INCH DIAMETER ROPE
SWL = ½ X ½ X 8 = 2 TONS

B) 5/8 INCH DIAMETER ROPE
SWL = 5/5 X 5/8 X 8 = 3.125 TONS

C) 1 INCH DIAMETER ROPE
SWL X 1 X 1 X 8 = 8 TONS

MAXIMUM SAFE WORKING LOAD
"A" TYPE ALLOY STEEL CHAIN
SINGLE VERTICLE SLING

CHAIN SIZE (INCHES)	CAPACITY (POUNDS)
¼	3,250
3/8	6,600
½	11,250
5/8	16,500
¾	23,000
7/8	28,750
1"	38,750
1 1/8	44,500
1 ¼	57,500
1 3/8	67,000
1 ½	80,000
1 ¾	100,000

INSTALLATION OF WIRE ROPE CLIPS

ROPE DIAMETER (INCHES)	MINIMUM NO. OF CLIPS	AMOUNT OF ROPE TURN BACK FROM THIMBLE (INCHES)	TORQUE IN FOOT-POUNDS UN-LUB-RICATED BOLTS
1/8	2	3 ¼	-
3/16	2	3 ¾	-
¼	2	4 ¾	15
5/16	2	5 ½	30
3/8	2	6 ½	45
7/16	2	7	65
½	3	11 ½	65
9/16	3	12	95
5/8	3	12	95
™ ¾	4	18	130
7/8	4	19	225
1"	5	26	225
1 1/8	6	34	225
1 ¼	6	37	360
1 3/8	7	44	360
1 ½	7	48	360
1 5/8	7	51	430
1 ¾	7	53	590
2"	8	71	750
2 ¼	8	73	750
2 ½	9	84	750
2 ¾	10	100	750
3"	10	106	1200

HYDRAULICS AND PUMPS

1. DEMULSIBILITY IS THE ABILITY OF THE OIL TO
ANS. SEPARATE FROM WATER

2. WHEN OXIDATION OF AN OIL TAKES PLACE
ANS. SLUDGE IS FORMED

3. HYDRAULIC OPIL USED IN LOW TEMPERATURE SERVICES SHOULD HAVE LOW
ANS. POUR POINT

4. ONE DISADVANTAGE OF SYNTHETIC BASED FIRE-RESISTANT FLUIDS IS THAT THEY
ANS. ATTACK PACKING NORMALLY USED IN HYDRAULIC SYSTEMS

5. WHAT IS THE CHIEF CAUSE OF FOAMING IN AN OIL RESERVOIR
ANS. TO MUCH AIR IN THE SYSTEM

6. BAFFLES ARE USED IN AN OIL RESERVOIR CHIEFLY TO
ANS. TEMPORARILY SEPARATE THE INCOMING OIL FROM THE OUTGOING OIL

7. WHICH OIL WILL SHOW THE SMALLEST CHANGE IN VISCOSITY FOR A GIVEN CHANGE IN TEMPERATURE
ANS. OIL (A) VISCOSITY INDEX 100

8. THE NUMBER OF POUNDS OF FORCE APPLIED TO AN AREA IS EXPRESSED IN
ANS. P.S.I.

9. THE THEORY STATING THAT PRESSURE IN A CONFINED LIQUID IS DISTRIBUTED EQUALLY THROUGHOUT THE FLUID IS
ANS. PASCAL'S LAW

10. THE EMMERSION (SUMP TYPE) FILTER IS CONNECTED TO THE
ANS. SUCTION LINE OF THE PUMP

11. THE TERM "FULL FLOW FILTER" MEANS THAT
ANS. ALL OIL PASSES THROUGH THE FILTER

12. THE PURPOSE OF THE PUMP IN EVERY FLUID POWER SYSTEMIS TO
ANS. INITIATE FLUID FLOW

13. PRESSURE IN A HYDRAULIC SYSTEM IS CREATED BY THE
ANS. RESISTANCE OF FLUID FLOW

14. SPUR GEAR, INTERNAL GEAR, SLIDING VANE AND SCREW PUMPS ARE ALL
ANS. ROTARY PUMPS

15. THE EFFICIENCY OF A CENTRIFUGAL PUMP IS CHIEFLY DETERMINDED BY THE
ANS. TYPE OF IMPELLER

16. IN A HYDRAULIC SYSTEM REQUIRING A RANGE IN PRESSURE FROM VERY LOW TO VERY HIGH, USE A
ANS. RECIPROCATING PUMP

17. THE MOST COMMON TYPE OF PUMP USED IN HYDRAULIC SYSTEMS IS THE
ANS. ROTARY PUMP

18. TO AVOID THE POSSIBILITY OF RUPTURING THE PUMP CASING OR DISCHARGE PIPE, A POSITIVE DISPLACEMENT ROTARY PUMP SYSTEM IS FITTED WITH
ANS. PRESSURE RELIEF VALVE

19. PUMP CAVITATION MAY BE CAUSED BY
ANS. TOO SMALL A PUMP INTAKE PORT

20. WHEN A FLUID IS FLOWING AT A CONSTANT G.P.M. THROUGH TWO CONTINUOUS PIPES OF DIFFERENT DIAMETERS THE
ANS. VELOCITY IS GREATER IN THE SMALLER PIPE

21. WHAT TYPE OF THEARD IS NORMALLY USED ON HYDRAULIC LINES
ANS. DRYSEAL

22. THE MAJOR CAUSE OF VALVE FAILURE IS
ANS. CONTAMINANTS

23. A SOLENOID IS OFTEN USED TO OPERATE A SMALL SPOOL VALVE THE FIRST STEP OF THE OPERATION OCCURS WHEN
ANS. A CURRENT PASSES THROUGH THE SOLENOID

24. DIRECTIONAL CONTROL VALVES ARE IDENTIFIED BY THEIR NAME AND THE NUMBER OF
ANS. FLOW PATHS

25. THE PROTECTOR OF THE HYDRAULIC CIRCUIT IS A
ANS. RELIEF VALVE

26. THE PRESSURE AT WHICH A CHECK VALVE WILL START TO OPEN IS CALLED
ANS. CRACKING PRESSURE

27. SPOOL VALVES ARE USED TO
ANS. CONTROL DIRECTION OF FLOW

28. A SIMPLE NON-PRESSURE COMPENSATED FLOW CONTROL VALVE
ANS. MAY HAVE A FIXED ORIFICE OR AN ADJUSTABLE NEEDLE VALVE

29. WHAT IS ANOTHER TERM FOR THE MAXIMUM PRESSURE OD A POPPET RELIEF VALVE
ANS. SET PRESSURE

30. AN ELECTRO HYDRAULIC SERVO VALVE RECEIVES ITS OPERATING SIGNALS FROM
ANS. BOTH AN INPUT SIGNAL AND A FEED BACK SIGNAL

31. AN UNLOADING RELIEF VALVE IS USED IN ACCUMULATOR CHARGING CIRCUITS TO
ANS. LIMIT MAXIMUM PRESSURE AND UNLOAD THE PUMP WHEN THE DESIRED ACCUMULATOR PRESSURE IS REACHED

32. THE DIFFERENCE BETWEEN FULL-FLOW PRESSURE AND CRACKING PRESSURE IS SOMETIMES CALLED
ANS. PRESSURE OVERIDE

33. A SNUBBER IN A HYDRAULIC SYSTEM IS USED TO
ANS. PREVENT THE GUAGE FROM OSCILLATING AND TO PROTECT THE GUAGE FROM PRESSURE SURGES.

34. WHAT IS A HYDRAULIC FUSE
ANS. A THIN METAL DISC, ANALOGOUS TO AN ELECTRIC FUSE

35. WHICH HYDRAULIC DEVIDE IS USED FOR LIFTING, TILTING, CLAMPING, OPENING, CLOSING, TURNING AND SWINGING
ANS. ROTARY ACTUATOR

36. AN INTENSIFIER (OR PRESSURE BOOSTER) CONVERTS
ANS. A LARGE VOLUME. LOW PRESSURE OIL SUPPLY TO A SMALL VOLUME, HIGH PRESSURE OUTPUT.

37. THS SIMLEST TYPE OF CYLINDER IS THE
ANS. RAM TYPE

38. GENERALLY THE ROTATION OF THE SHAFT OF AN ACTUATOR DOES NOT EXCEED
ANS. 3608

39. A LARGE DIAMETER CYLINDER AND A SMALL DIAMETER CYLINDER EACH RECEIVE A FLOW OF 3 GALLONS PER MINUTE, THEREFORE, THE
ANS. SMALLER CYLINDER TRAVELS FASTER

40. A CYLINDER IS CUSHIONED TO PREVENT THE PISTON FROM
ANS. STRIKING THE END OF THE CYLINDER

41. THE ESSENTIAL PARTS OF A CYLINDER INCLUDE BARREL
ANS. PISTON, ROD, END CAP AND SEALS

42. THE MOST COMMON SEAL USED IN HYDRAULICS IS
ANS. AN "O" RING

43. AN EXAMPLE OF A STATIC SEAL IS A
ANS. GASKET

44. VANES IN A BALANCED VANE MOTOR ARE OFTEN HELD IN PLACE BY
ANS. SPRING CLIPS

45. AN EXAMPLE OF A NON-POSITIVE SEAL IS
ANS. A PISTON RING

46. INCREASING THE FLUID FLOW THROUGH A HYDRAULIC MOTOR ALSO INCREASES
ANS. SPEED

47. IF A HYDRAULIC MOTOR IS TURNING IN THE WRONG DIRECTION CHECK THE
ANS. PUMP TO MOTOR CONNECTION

48. HYDRAULIC SHOCK IN THE FLUID IS CONTROLLED BY A
ANS. SHOCK SURPRESSOR

49. IN A MECHANICAL SERVO, WHAT PART OF THE SERVO VALVE MOVES WITH THE LOAD
ANS. VALVE BODY

50. PRESSURE ACCUMULATORS ARE USED TO
ANS. STORE EXCESSPUMP DELIVERY

51. TYPE OF FILTER THET WOULD HARM OIL CHEMISTRY IS
ANS. ADSORBENT ACTIVE FILTERS

52. WHAT IS A HYDRAULIC ACTUATOR
ANS. A DEVICE FOR CONVERTING HYDRAULIC ENERGY INTO MECHANICAL ENERGY

53. NAME TWO TYPES OF ACTUATORS USED IN INDUSTRIAL HYDRAULICS
ANS.
1. LINEAR ACTUATORS (HYDRAULIC CYLINDERS)
2. ROTARY ACTUATORS (HYDRAULIC MOTORS)

54. WHAT IS THE FUNCTION OF AN ACCUMULATOR IN AN INDUSTRIAL HYDRAULIC SYSTEM
ANS. A COMPONENT USED TO STORE HYDRAULIC ENERGY

55. FILTERS ARE MEASURED IN

ANS. MICRONS

56. WHERE IS THE FILTER PLACED IN A HYDRAULIC CIRCUIT
ANS. 1. INLET 2. PRESSURE LINE 3. RETURN LINE
(EASY TO GET AT LOCATIONS)

57. SYSTEM PRESSURE IN HYDRAULIC SYSTEM IS HIGHEST AT
ANS. RELIEF VALVE SETTING

58. THE RESERVOIR, WHILE SUPPLING AN ADEQUATE SUPPLY OF OIL TO THE SYSTEM ALSO ALLOWS
ANS.
1. AIR IN THE SYSTEM TO ESCAPE
2. DIRT AND WATER TO SETTLE OUT
3. HEAT TO DISIPITATE

59. FILTERS SHOULD ONLY BE SUED TO
ANS. REMOVE FINE PARTICLES

60. WHEN PRESSURE TESTING A CYLINDER THAT BUILDS UP PRESSURE UNDER NO LOAD BUT CYLINDER DOES NOT ACTIVATE
ANS. THERE IS INTERNAL BINDING

61. HOW IS FLOW CONTROLED TO A HYDRAULIC CYLINDER
ANS. BY A FLOW CONTROL VALVE

62. DIRECTIONAL CONTROL VALVES ARE USUALLY CLASSES AS
ANS. TWO-WAY, THREE-WAY OR FOUR-WAY VALVES

63. THE PRESSURE AT WHICH A CHECK VALVE WILL START TO OPEN IS CALLED
ANS. ITS CRACKING PRESSURE

64. IN A HYDRAULIC SYSTEM WHAT TYPE OF VALVE REGULATES HOW SLOW OR HOW FAST ACTUATORS OPERATE.
ANS. FLOW CONTROL OR FLOW REGULATION VALVE

65. TYPE OF DIRECTIONAL VALVE FOR DOUBLE ACTING CYLINDER
ANS. FOUR-WAY DIRECTIONAL VALVE

66. A COUNTERBALENCY VALVE
ANS. USUALLY USED TO SUPPORT A HOISTED LOAD OR PREVENT A LOAD FROM DROPPING UNCONTROLLED

67. WHAT IS THE MOST COMMON FLUID HANDLED IN AN INDUSTRIAL PLANT
ANS. WATER

68. WATER SUPPLY SYSYTEM CAN BE CLASSIFIED AS A "DIRECT" OR
ANS. RECIRCULATING

69. CHEMICAL PUMPS USE SPECIAL MATERIALS FOR THE
ANS. CHAFT SEALS, PACKING GLANDS AND GASKETS

70. PUMPS THAT HANDLE HIGH VISCOSITY MATERIALS ARE USUALLY
ANS. POSITIVE DISPLACEMENT

71. SUMP PUMP IMPELLERS ARE PROTECTED FROM DAMAGING PARTICLES BY FITTING THE PUMP AT THE INLET WITH

ANS. SCREEN

72. A PUMP PLACED ABOVE THE FLUID IT IS PUMPING IS SAID TO HAVE A
ANS. SUCTION LIFT

73. STATIC SUTION LIFT IS THE DISTANCE FROM THE PUMP'S CENTERLINE TO
ANS. WATER SURFACE – SUCTION SIDE

74. WHEN THE LIQUID BEING PUMPED IS LOCATED ABOVE THE PUMP, IT OPERATES WITH A
ANS. SUCTION HEAD

75. THE VELOCITY HEAD PLUS ALL FRICTIONAL LOSSES AND THE STATIC HEAD EQUALS THE
ANS. TOTAL DYNAMIC HEAD

76. WHEN THE FLUID IS PUMPED INTO A VESSEL UNDER PRESSURE, THE DYNAMIC HEAD
ANS. INCREASES

77. A PUMP'S CURVE IS USED TO GRAPHICALLY ILLUSTRATE A PUMP'S
ANS. EFFICIENCY

78. INCREASED DYNAMIC HEADS DUE TO FRICTIONAL LOSSES CAN BE CAUSED BY
ANS. MANY VALVES AND FITTINGS

79. THE TYPE OF PUMP THAT HAS A VOLUTE TYPE CASING IS
ANS. CENTRIFUGAL

80. THE VELOCITY OF THE FLUID IN A CENTRIFUGAL PUMP IS DEVELOPED BY THE
ANS. IMPELLER

81. INTERNAL LEAKAGE IN A CENTRIFUGAL PUMP IS RESTRICTED BY THE PUMP'S
ANS. WEARING RINGS

82. THE PACKING GLANDS OF PUMPS HANDLING HOT MATERIALS ARE USUALLY
ANS. COOLED

83. A HARIZONTALLY SPLIT CASING IS SPLIT ON THE
ANS. SHAFT CENTER LINE

84. AXIAL-FLOW PUMPS USUALLY OPERATE UNDER CONDITIONS OF
ANS. LOW HEAD – HIGH VOLUME

85. PROPELLER PUMPS THAT HANDLE GRITTY RAW WATER ARE USUALLY MADE OF
ANS. ABRASION RESISTANT ALLOYS

86. VERTICAL TURBINE PUMP BOWLS ARE USUALLY FITTED WITH
ANS. SUPPORT BEARINGS

87. GEAR TYPE POSITIVE DISPLACEMENT PUMPS ARE MORE PROPERLY CALLED
ANS. ROTARY PUMPS

88. ALIGNMENT BETWEEN THE END CAPS AND CASINGS OF A GEAR PUMP IS MAINTAINED BY THE USE OF
ANS. DOWEL PINS

89. THE FLUID CANNOT RETURN TO THE SUCTION SIDE OF A GEAR PUMP BECAUSE OF
ANS. MESHING OF THE GEARS

90. SHAFT MISALIGNMENT WILL CAUSE A ROTARY PUMP TO
ANS. WEAR

91. THE END COVER OF AN INTERNAL GEAR PUMP SUPPORTS THE
ANS. INNER GEAR

92. PUMPS OPERATING AT HIGH ELEVATIONS ARE SUBJECT TO A DECREASED
ANS. SUCTION LIFT

93. SHUTTING OF THE FLUID DISCHARGE TO AN AIR-OPERATED RECIPROCATING PUMP WILL CAUSE THE PUMP TO…
ANS. STALL

94. SELF-ADJUSTING DRIVING END PISTON RINGS ARE USUALLY MADE OF
ANS. CAST IRON

95. THE VALVES IN THE LIQUID END OF A STEAM OPERATED RECIPROCATING PUMP ARE USUALLY OF THE
ANS. VALVE PLATE TYPE

96. VALVES THAT CONTROL STEAM FLOW ON THE DRIVE SIDE OF A RECIPROCATING PUMP ARE OPERATED
ANS. MECHANICALLY

97. THE TERM "SIMPLEX PUMP" REFERS TO
ANS. NUMBER OF FLUID END CYLINDERS

98. A RECIPROCATING PUMP THAT PUMPS FLUID ON ONE SIDE OF THE PISTON IS CALLED
ANS. SINGLE-ACTING PUMP

99. THE TWO MOST COMMON CLASSES OF "METERING" PUMPS ARE THE
ANS. DIAPHRAGM AND PLUNGER TYPE

100. METERING OF THE FLUID IN MANY PLUNGER PUMPS IS ACCOMPLISHED BY ADJUSTING THE
ANS. CONNECTING ROD

101. IN A HYDRAULICALLY POWERED DIAPHRAGM PUMP, THE PUMP FLUID IS METERED BY THE
ANS. PUMPING FLUID

102. HOW ARE REMOTELY CONTROLLED METERING PUMPS ACTUATED
ANS. PNEUMATICALLY AND ELECTRICALLY

103. WHEN AN AIR-OPERATED RECIPROCATING PUMP IS RETURNED BY SPRING POWER, FLUID IS
ANS. DRAWN INTO THE CYLINDER

104. IMPELLERS OF SEALLESS PUMPS HAVE MAGNETIC HUBS BECAUSE THEY
ANS. PROVIDE SPEED AND POSITIONAL CONTROL

105. A SEALLESS PUMP SHOULD BE INSTALLED SO IT HAS A
ANS. SUCTION HEAD

106. MOST SLURRY PUMPS ARE CONSTRUCTED TO
ANS. BE EASILY MAINTAINED

107. LOW VISCOSITY CHEMICALS GENERALLY ARE BEST HANDLED BY

ANS. CENTRIFUGAL PUMPS

108. CHEMICAL PUMPS MUST BE SELECTED ON THE BASIS OF
ANS, THE FLUID THEY ARE HANDLING

109. PERISTALTIC SCREW PUMPS ARE SOMETIMES REVERSED TO
ANS. CLEAR THE SUCTION LINE

110. A SMALL AMOUNT OF LEAKAGE FROM A PACKING GLAND AIDS IN
ANS. COOLING THE GLAND

111. A COMMON TYPE OF PACKING GLAND USED FOR INDUSTRIAL PUMPS IS THE
ANS. SOLID PACKED

112. HOW MANY PACKING RINGS MAY BE ADDED AFTER THE PUMP HAS BEEN RUNNING
ANS. 1

113. THE TWO COMPONENTS OF A MECHANICAL PACKING SEAL MUST BE
ANS. MATED PROPERLY

114. A MECHANICAL SEAL IS BALANCED BY
ANS. FLUID PRESSURE

115. WEARING RINGS ARE USUALLY MADE ADJUSTABLE BY
ANS. THREADS

116. THE TWO CLASSIFICATIONS OF PUMP BEARINGS ARE THE
ANS. JOURNAL AND ANTIFRICTION TYPES

117. IF THE ROTOR IS CENTERED ON A VARIABLE VANE PUMP IT WILL
ANS. PUMP 0 VOLUME (NO PUMPING ACTION)

118. CRESENT SHAPE IS FOUND IN
ANS. INTERNAL GEAR PUMP

119. BLOCKED HYDRAULIC LINE WILL
ANS. DAMAGE PUMP

120. TO INCREASE VOLUME OUTPUT FROM PISTON PUMP
ANS. INCREASE STROKE

121. AFTER INSTALLING A GEAR PUMP AND NO FLUID WILL PUMP, FIRST CHECK
ANS. ROTATION OF PUMP

122. ROOF FANS ARE FOR
ANS. POLLUTION PURPOSESS

123. WHAT IS THE POSITION OF LANTERN RING IN STUFFING BOX
ANS. CENTERED UNDER THE SEALING FLUID INLET PIPE CONNECTION

124. WHEN PUMPING CORROSIVE MATERIALS YOU SHOULD
ANS. SEAL FLUID FROM EXTERNAL SOURCE

125. WHAT TYPE OF LINE SHOULD BE USED ON A HYDRAULIC MOTOR ON A VIBRATING BASE
ANS. HOSE

126. WHAT IS THE MOST IMPORTANT THING TO REMEMBER WHEN MOUNTING A PUMP ABOVE FLUID LEVEL
ANS. SHORTEST LINE POSSIBLE WITH SLIGHT RISE IN THE SUCTION LINE TO PUMP

127. A BLOCKED HYDRAULIC SUCTION LINE WILL
ANS. DAMAGE PUMP

128. MOST IMPORTANT THING TO REMEMBER WHEN ALIGNING PUMP AND MOTOR
ANS. TEMPERATURE VARIATIONS BETWEEN PUMP AND MOTOR

129. MAJOR CRACKS IN AN IMPELLER CAN BE CURE BY
ANS. WELDING OR REPLACE IMPELLER

130. WHAT IS THE ADVANTAGE OF A STEEL FABRICATED BASE OVER A CAST IRON BASE
ANS. EASILY MODIFIED, NOT LIABLE TO CRACK

131. REASON FOR REMOVABLE BASE BOLTS
ANS. BOLTS CAN BE REPLACED WILL VERY LITTLE EFFORT

BEARINGS

1. WHAT BASIC FUNCTION DO BEARINGS PROVIDE

ANS.
1. CONFINE THE MOTION OF MOVING COMPONENTS
2. SUPPORT MOVING SHAFTS AND SLIDES
3. REDUCE FRICTION AND VIBRATION

2. A JOURNAL BEARING CONTROLS WHAT KIND OF SHAFT MOTION

ANS. RADIAL

3. WHICH OF THE FOLLOWING DESCRIBES THE HARDNESS OF PLAIN BEARINGS IN RELATION TO THE HARDNESS OF THE COMPONENTS THEY GUIDE AND SUPPORT

ANS. SOFTER

4. THE TWP PRINCIPLE CATEGORIES OF BEARINGS ARE

ANS. PLAIN AND ANTI-FRICTION

5. IF AN ANTI-FRICTION BEARING FAILS DUE TO NORMAL USE, WHAT IS THE FAILURE CALLED

ANS. FATIGUE FAILURE

6. WHICH OF THE FOLLOWING IS AN ADVANTAGE THAT PLAIN JOURNAL BEARINGS HAVE OVER ANTI-FRICTION BEARINGS

ANS.
1. LESS RADIAL SPACE REQUIRED
2. USUALLY A LOWER FIRST COST
3. LESS RESISTENCE TO SHOCK

7. A LUBRICANT FOR A PLAIN BEARING DOES WHICH OF THE FOLLOWING

ANS.
1. PROVIDES A FILM TO SEPARATE MOVING PARTS
2. REDUCES FRICTION
3. HELPS TO CARRY HEAT AWAY FROM THE BEARING

8. THE CHARACTERISTIC WHICH PERMITS A PLAIN JOURNAL BEARING MATERIAL TO ABSORB DIRT IS ITS

ANS. EMBEDDABILITY

9. WHICH OF THE FOLLOWING IS "NOT" USUALLY PART OF A STANDARD ANTI-10. FRICTION BEARING

ANS. LUBRICATION GROOVES

10. WHAT DETERMINES THE LOAD CARRYING CAPACITY OF ANTI-FRICTION BEARINGS

ANS.
1. SIZE OF BEARING
2. NUMBER OF ROLLING ELEMENTS
3. TYPE OF RACES

11. THE FOLLOWING ELEMENTS OF ANTI-FRICTION BEARINGSARE

ANS. BALLS AND ROLLERS

12. THE SELECTION OF ANTI-FRICTION BEARING FITS DEPEND ON

ANS. LOAD TO BE CARRIED, BEARING DIMENSION AND MOUNTING DESIGN

13. YOU ARE GOING TO PRESS A BALL BEARING ONTO A SHAFT, WHAT MUST YOU BE CAREFUL "NOT" TO DO

ANS. PRESS ON THE OUTER RACE

14. HOW DO YOU REDUCE CLEARANCE IN A PLAIN SPLIT BABBIT BEARING

ANS. REMOVE SHIMS

15. TO OBTAIN A CLOSE BEARING FIT (APPROX 75%) IN BABBIT WE USE

ANS. MECHANIC'S BLUE AND BEARING SCRAPER

16. ONE OF THE USUALL CAUSES OF BEARING FAILURE AFTER PROPER AND CORRECT INSTALLATION OF THE BEARING IS
ANS. TOO MUCH LUBRICATION IN THE BEARING

17. ONE THING TO KEEP IN MIND INSTALLING ANTI-FRICTION BALL BEARINGS IS
ANS. CLEARANCE BETWEEN BALLS AND INNER AND OUTER RACEWAYS

18. PREMATURE BEARING FAILURE CAN BE CAUSED BY THE FOLLOWING CONDITIONS
ANS. MISALIGNMENT, EXCESSIVE RUNOUT AND IMPROPER LUBRICATION

19. THE FOLLOWING PRECAUTIONS SHOULD BE OBSERVED IN THE INSTALLATION OF ROLLER BEARINGS
ANS.
1. DO NOT UNWRAP THE BEARING UNTIL THEY ARE REQUIRED FOR INSTALLATION
2. UNDER NO CONDITION MOUNT THE BEARING BY EXERTING FORCE OVER OR THROUGH THE ROLLER ELEMENTS
3. DO NOT WASH A NEW BEARING AS THIS WILL REMOVE THE PROTECTIVE FILM

20. WHAT LOAD DOES THE FIXED BEARING CARRY IN A FIXED AND FLOATING TWO BEARING MOUNTING
ANS. THRUST

21. TO PREVENT CREEPING OR SPINNING OF THE INNER RING USE A
ANS. TAPERED ADAPTER SLEEVE

22. BEARING FATIGUE FAILURE STARTS AS
ANS. FLAKING

23. WHY DID THE FULL-TYPE BEARING FAIL WHEN IT WAS USED AS A REPLACEMENT FOR A "CONRAD BEARING
ANS. CANNOT TAKE THRUST LOADS, BECAUSE OF ITS LOADING SLOT

24. THE BALL BEARING WHICH RESISTS LOAD FROM ANY DIRECTION BEST IS
ANS. DOUBLE-ROW ANGULAR-CONTACT

25. WHICH ROLLER BEARING HAS THE GREATEST LOAD CPACITY, SIZE FOR SIZE
ANS. NEEDLE ROLLER

26. OF THE FOLLOWING ROLLER BEARING, WHICH IS DESIGNED TO CARRY COMBINED RADIAL AND THRUST LOADS
ANS. TAPERED ROLLER

27. THE TYPE OF ROLLER BEARING MOST RESISTANT TO SHOCK AND ABRASION IS
ANS. WOUND ROLLER

28. WHICH BEARING IS DESIGNED TO PROVIDE ADJUSTMENT FOR SHAFT-CENTRE DISTANCES
ANS. TAKEUPS

29. WITH THE USE OF ACIDS OR CAUSTIC SOLUTIONS, THE BEST MATERIAL TO USE FOR BEARINGS IS
ANS. PHENOLIC PLASTIC

30. WITHOUT LOSING ANY OF ITS LOAD CARRYING CAPACITY, WHICH BEARING ADJUSTS TO MISALIGNMENT

ANS. SPHERICAL ROLLER

31. AN ADVANTAGE OF CARBON-GRAPHITE BEARING IS
ANS. SELF-LUBRICATION, HEAT-RESISTANCE AND STRENGTH

32. BEARINGS CAN BE REMOVED EASIER BY USING
ANS. HEAT

33. MOST HASTY BEARING INSTALATIONS RESULT IN
ANS. EARLY BEARING FAILURE

34. BALL AND ROLLER BEARINGS THAT ARE MISALIGNED USUALLY
ANS. SHORTEN THEIR OPERATING LIFE

35. BEARINGS SHOULD BE CHECKED FOR FREE MOVEMENT
ANS. AFTER THEY ARE MOUNTED ON THE SHAFT

36. SHINY SPOTS ON THE CONTACT SURFACE OF A PLAIN JOURNAL BEARING INDICATE
ANS. IMPROPER ALIGNMENT

37. AFTER A BEARING HAS BEEN CLEANED, IT SHOULD RECEIVE A COATING OF
ANS. OIL (LIGHT)

38. A DARK-COLORED BEARING FOUND DURING A ROUTINE INSPECTION INDICATE
ANS. OVERHEATING

39. FOREIGN MATTER CAN BE EFFECTIVELY KEPT OUT OF ANTI-FRICTION BALL BEARINGS BY
ANS. SEALS AND SHIELDS

40. WHAT IS THE PURPOSE OF THE TIGHTLY WOUND ENDLESS GARTER SPRING IN AN OIL OR GREASE SEAL
ANS. TO MAINTAIN A LIGHT PRESSURE BETWEEN SHAFT AND CONTACT MATERIAL

41. WHAT IS THE PURPOSE OF SPRINGS IN A MECHANICAL SEALS
ANS. THE SPRING MAINTAINS SEALING CONTACT AND ADJUSTS FOR SHAFT END PLAY, RUN-OUT AND SEAL FACE WEAR

42. WHEN INSTALLING BEARINGS USING AN OIL BATH, THE TEMPERATURE SHOULD NOT GO ABOVE
ANS. 2508 F

43. USING BOILING WATER TO INSTALL A BEARING THE TEMPERATURE WILL NOT EXCEED
ANS. 2128 F

44. HOW MUCH OIL SHOULD BE IN A BALL BEARING AT REST
ANS. ½ WAY UP FROM BOTTOM OF BALL

45. WHAT STYLE OF FRICTION BEARING SHOULD BE USED IF THE LOAD IS APPLIED PARRALLEL OR SLIGHTLY ABOVE THE HORIZONTAL
ANS. ANGLE STYLE BEARING

46. TO REMOVE A BEARING FROM A SHAFT USING A HAMMER
ANS. A PUNCH OR BAR OR MILD STEEL IS USED TO DRIVE AGAINST THE INNER RACE

47. TO POSITION A BEARING ON A SHAFT USING A HAMMER
ANS. USE A MOUNTING TUBE WITH PLATE OR A HARDWOOD BLOCK

48. SHAFT-TO-BORE MISALIGNMENT (S.T.B.M.) IS
ANS. THE AMOUNT BY WHICH THE SHAFT IS OFF CENTRE, WITH RESPECT TO BORE'S CENTRE

49. DYNAMIC RUN-OUT IS
ANS. THE AMOUNT BY WHICH THE SHAFT DOES "NOT" ROTATE AROUND THE CENTRE

50. TYPE OF PACKING USED FOR HIGH TEMPERATURE APPLICATIONS
ANS. METALLIC PACKING

<u>CLEANING & INSPECTION OF BEARINGS</u>

IF NO VISUAL SIGNS OF DAMAGE AND WEAR ARE PRESENT, HOLD THE BEARING AND ROTATE THE OUTER RACE SLOWLY. NEVER SPIN IT. IF ANY CLICKING OR STICKING IS FOUND, RECLEAN THE BEARING. IF AFTER CLEANING THE CONDITION STILL EXITS, REPLACE THE BEARING.

THRUST BEARING OR TAPERED ROLLER BEARINGS CAN BE INSPECTED IN THE SAME WAY, EXCEPT PLACE THEBEARING ON A CLEAN SURFACE AND LIGHTLY APPLY HAND PRESSURE AND ROTATE THE BEARING.

IF THE BEARINGS ARE NOT TO BE REINSTALLED AT ONCE, WRAP THEM IN A CLEAN, OIL-PROOF PAOPER, PLACE IN A CLEAN BOX AND STORE INA DRY, DUST-FREE PLACE. WHEN THE BEARINGS ARE FOUND TO BE DAMAGED, THE CAUSE MUST BE DETER MINED OR IT MAY OCCUR AGAIN WHEN THE NEW BEARINGS IS INSTALLED.

<u>CLEANING & IINSPECTING OF BEARINGS</u>

IF BEARINGS MAY BE REINSTALLED, INSPECT THEM CAREFULLY. WHEN SOME DOUBT EXISTS WHETHER OR NOT TO REPLACE THE BEARING, USE THIS REASONING --- IF FREQUENT INSPECTIONS ARE GIVEN AND THE BEARING IS EASY TO REPLACE. THEN THE RISK OF FAILURE MAY NOT BE SO GREAT; HOWERVER, IF INFREQUENT INSPECTION TAKE PLACE AND THE BEARING IS DIFFICULT TO REMOVE AND INSTALL, THEN THE DOUBTFUL PART SHOULD BE REPLACED WITH A NEW ONE.

IF THE BEARINGS HAVE SEALS OR SHIELDS, ALSO INSPECT THEM FOR DAMAGE AND WEAR. IF THE SEALS ARE NOT REMOVABLE AND THEY ARE DAMAGED OR WORN, THE WHOLE BEARING MUST BE REPLACED. BE SURE TO REPLACE THOSE SEALS THAT ARE REPLACEABLE IF THEY ARE DEFECTIVE. WORN OR DAMAGED SEALS WILL ALLOW DIRT AND MOISTURE TO ENTER THE BEARING AND SHORTER BEARING LIFE.

VISUALLY INSPECT THE EXTERIOR OF THE BEARING FOR CRACKS IN THE RACES, DENTED SEALS, AND BROKEN OR DAMAGED SEPARATORS, BALLS OR ROLLERS. IF THE BEARINGS HAS BEEN OVERHEATED, IT WILL BE A BROWNISH BLUE OR BLUISH BLACK COLOUR. IF ANY OF THESE SIGNS ARE FOUND, THE BEARING SHOULD BE REPLACED.

INSPECT SEPARABLE BEARINGS FOR PITTED, SCRATCHED OR FLAKED BALLS, ROLLERS, OR RACES. REPLACE THE BEARING IF ANY OF THESE SIGNS OF DAMAGE ARE FOUND.

THE INNER SURFACES AND ROLLER ELEMENTS IN A SUSPECTED NON-SEPARABLE BEARING MAY BE EXAMINED WITH EITHER A SMALL FLASHLIGHT OR REFLECTED LIGHT FROM A STRONG LIGHT SOURCE. ANY VISIBLE PITS OR SCRATCHES ARE SIGNS OF DAMAGE AND THE BEARING SHOULD BE REPLACED.

PNEUMATICS & COMPRESSORS

1. WHAT IS THE MOST COMMON METHOD OF REMOVING WATER VAPOUR FROM COMMPRESSED AIR
ANS. CONDENSATION

2. THE AMOUNT OF CONDITIONING REQUIRED BY THE COMPRESSED AIR AFTER IT LEAVES THE COMPRESSER IS DETERMENED BY THE
ANS. USE IN WHICH THE AIR IS PUT

3. LUBRACATING EQUIPMENT SHOULD ALWAYS BE PLACED AFTER
ANS. REGULATOR

4. A COMPRESSER RELIEVED OF ALL INTERNAL PRESSURE IS CONSIDERD TO BE
ANS. UNLOADED

5. IN A PNEUMATICS SYSTEM, THE FORCE THAT DOES THE WORK IS SUPPLIED IN THE FORM OF
ANS COMPRESSED AIR

6. DYNAMIC AIR COMPRESSORS INCREASE AIR PRESSURE BY
ANS ACCLERATING THE AIR

7. AN AIR REGULATING VALVE IS USUALLY INTSALLED
ANS WITH A LUBRACATOR AND FILTER

8. A GUAGE GRADUATED IN INCHES OF MERCURY MEASURES
ANS VACUUM

9. WHAT IS THE A COMMON FEATURE OF COOLED AIR COMPRESSERS
ANS COOLING FINS

10. IN MULTISTAGE COMPRESSORS, THE REQUIRED AIR PRESSURE IS CREATED BY COMPRESSING THE AIR IN
ANS TWO OR MORE UNEQUAL CYLINDERS

11. WHAT TYPE OF COMPRESSOR WILL DELIVER LARGE VOLUMES OF OIL-FREE AIR AT APPROXIMATELY 100 P.S.I
ANS. ROTARY DRY SCREW

12. A VANE TYPE AIR COMPRESSOR IS USED TO PRODUCE
ANS. LOW PRESSURE AND HIGH VOLUME

13. THE MOST COMMON IN AIR INCLUDE
ANS. WATER VAPOUR AND DIRT

14. DUST PARTICLES THAT CONTACT OIL SPRAY AND MIST USUALLY
ANS. COLLECT IN THE LUBRICANT

15. THE MOST EFFCIENT WAY OF REMOVING LARGE PARTICLES FROM THE AIR STREAM IS BY USING
ANS. A SURFACE FILTER

16. A STRAINER OR FILTER IS CLASSIFIED BY THE
ANS. SIZE OF THE PARTICLES IT STOPS

17. MOST NON-METALLIC TUBBING USED IN PNEUMATIC LINES IS LIMITED TO CONDITIONS OF
ANS. 100 PSI AND 190 DEGREES F

18. WHAT IS THE PURPOSE OF FLARED CONNECTIONS WITH LONG SHOULDERED NUTS
ANS. TO PROVIDE SUPPORT

19. THE RATE OF SLOPE FOR COMPRESSED AIR PIPING SHOULD BE
ANS ONE INCH PER 10 FEET

20. MAIN PIPES ON A PNEUMATIC MACHINE ARE USUALLY MADE OF
ANS. STEEL

21. MANIFOLDS ARE USED BECAUSE THEY
ANS. ELIMANATE A CONSIDERABLE AMOUNT OF PIPING, REDUCE ASSEMBLY TIME, PERMIT A RAPID CHANGE OF VALVE WITHOUT DISTURBING THE PIPING AND ALSO STREMLINES A MACHINE

22. AN AUTOMATIC CHECK VALVECAN BE FURTHER CLASSIFIED AS A
ANS. TWO WAY, TWO POSITION VALVE

23. A THREE WAY VALVE HAS HREE
ANS. PRIMARY CONNECTIONS

24. AUTOMATICALLY OPERATED FLOW CONTROL VALVES ARE MOST COMMONLY ACTUATED BY
ANS. SOLENOIDS

24. THE BEST LOCATION FOR A PRESSURE REGULATOR VALVE IN A PNEUMATIC SYSTEM IS
ANS. AT AN AIR STATION

26. THE SEALING POINT OF A BALL POPPET VALVE IS LOCATED IN THE
ANS. VALVE BODY

27. REMOTE-CONTROLLED REGULATORS WILL NOT FUNCTION WITHOUT
ANS. REGULATED PILOT AIR

28. AN AIR RECEIVER IS TESTED BY PRESSURING IT WITH
ANS. WATER

29. A CYLINDER THAT PRODUCES WORK ONLY ON IT'S RETURN STROKE IS CALLED
ANS. SINGLE-ACTION CYLINDER

30. A PNEUMATIC CYLINDER FURNISHES WITH THE MOUNTING LUGS OR FEET IS CLASSIFIED AS BEING
ANS. FIXED, NON-CENTERLINE MOUNTED

31. THE AMOUNT OF MOTION IN A PIVOTING MUST BE RESTRICTED TO PREVENT
ANS. PISTON ROD FROM BENDING

32. MECHANICAL SHOCKS CAN BE PREVENTED IN A PNEUMATIC CYLINDER BY USING
ANS. CUSHIONING DEVICE

33. THE PRIMARY PURPOSE OF ALL THE PRESSURE CONTROLS IN A PNEUMATIC SYSTEM IS TO
ANS. LIMIT AIR PRESSURE

34. WHICH OF THE TYPES OF RELIFE VALVES PROVIDE THE SMOOTHEST RELIFE CONTROL
ANS. DIAPHRAGM

35. A SNUBBER IS USED TO

ANS. PROTECT PRESSURE GUAGE

36. THE MOST COMMON PRESSURE SENSITIVE DEVICE IS THE
ANS. BOURDON ELEMENT

37. COMPARED TO HYDRAULIC PUMPS, INTENSIFIERS
ANS. ARE MORE USEFUL IN APPLACATIONS REQUIRING LENGTHLY HIGH PRESSURE HOLDING PERIODS, AND REQUIRE LESS AMOUNT OF HIGH PRESSURE FLUID

38. THE MOST COMMON QUANTITIES MEASUREED AND CONTROLLED IN INDUSTRY ARE
ANS. TEMPERTURE, PRESSURE, FLOW AND LIQUID LEVEL

39. FOR ON-OFF CONTROL, THE FINAL CONTROL ELEMENT IS ALWAYS
ANS. FULL ON OR FULL OFF

40. THE PROPORTIONAL CONTROLLER PROVIDES AN OUTPUT PROPORTIONAL TO THE
ANS. ERROR BETWEEN INPUT AND SET POINT SIGNAL

41. RATE CONTROL IN THE CONTROLLERS IS USED TO PROVIDE ADDITIONAL OUTPUT WHEN THE PROCESS IS
ANS. CHANGING

42. WHICH IS THE BASIC PART OF A PNEUMATIC TRANSDUCER
ANS. FLAPPER AND NOZZLE

43. A VANE PNEUMATIC MOTOR IS USUALLY USED TO POWER
ANS. PORTABLE GRINDERS

44. CHIPPING HAMMERS ARE POWERED BY
ANS. A RECIPROCATING PISTON

45. MOST PORTABLE ROTARY AIRTOOLS ARE DRIVEN BY
ANS. VANE MOTORS

46. ON MOST PRESSURE GUAGES A READING OF ZORE INDICATES THE GAUGE IS MEASURING
ANS. ATMOSPHERIC PRESSURE AND 30 INCHES OF MERCURY

47. THE HORSE POWER OUTPUT OF A PNEUMATIC MOTOR IS CALCULATED ON THE BASIS OF THE MOTOR'S
ANS. TORQUE AND SPEED

48. ALL PNEUMATIC MOTORS ARE CONSTRUCTED WITH A MECHANICAL SEAL AND OPERATE ON THE PRINCIPLE OF
ANS. POSITIVE DISPLACEMENT

49. WHAT IS THE MOST IMPORTANT CONSIDERATION WHEN SELECTING A PNEUMAIC MOTOR
ANS. AIR CONSUMPTION

50. THE DIRECTION OF ROTATION IN A PNEUMATIC MOTOR IS REVERSED BY MEANS OF REVERSING
ANS. AIRFLOW

51. WHEN HEAT IS APPLIED TO GAS CONTAINED IN A CYLINDER THE

ANS. PRESSURE INCREASES

52. WHAT TYPE OF ENERGY IS PRODUCED BY AN AIR COMPRESSOR
ANS. PNEUMATIC

53. WHEN AIR IS COMPRESSED WHICH OF THE FOLLOWING IS INCREASED
ANS. TEMPERATURE AND PRESSURE

54. TO BE EFFICIENT, A POSITIVE DISPLACEMENT COMPRESSOR MUST DECREASE THE GAS
ANS. VOLUME

55. DYNAMIC COMMPRESSORS INCREASE AIR PRESSURE BY
ANS. ACCELERATING THE AIR

56. THE DISCHARGE VALVES OF A COMPRESSOR ARE OPENED BY
ANS. COMPRESSED AIR

57. IN MULTISTAGE COMPRESSORS, THE REQUIRED AIR PRESSURE IS CREATED BY COMPRESSING THE AIR IN
ANS. TWO OR MORE UNEQUAL CYLINDERS

58. AIR-COOLED COMPRESSORS ARE USUALLY CONSTRUCTED WITH
ANS. COOLING FINS

59. THE PURPOSE OF THE CRANKSHAFT AND CONNECTING ROD IS TO
ANS. CONVERT ROTARY MOTION INTO RECIPROCATING MOTION

60. WHAT LUBRICATING METHOD IS USED FOR HEAVY DUTY COMPRESSORS
ANS. PRESSURIZED

61. THE COMPRESSING LOADS OF A WET SCREW COMPRESSOR ARE DRIVEN WITHOUT
ANS. TIMING GEARS

62. IMPELLER COMPRESSORS ARE FREQUENTLY REFERRED TO AS
ANS. BLOWERS

63. THE MOST EFFICIENT METHOD OF CONTROLLING THE OURPUT OF A CENTRIFUGAL COMPRESSOR IS BY
ANS. SPEED VARIATION

64. THE IMPELLERS OF DINAMICCOMPRESSORS ROTATE AT HIGH SPEED TO ENSURE
ANS. EFFICIENT OPERATION

65. A CENTRIFUGAL COMPRESSOR IS CLASSIFIED AS
ANS. DYNAMIC COMPRESSOR

66. THE FUNCTION OF AN AIR RECEIVER IS
ANS. IT DAMPENS PULSATIONS, SERVES AS A RESERVOIR AND IT SERVES TO PRECIPITATE SOME OF THE MOISTURE

67. THE MAJOR ADVANTAGE OF AIR-COOLED OVER WATER-COOLED IS THAT
ANS. THERE IS NO DANGER OF FREEZING

68. INTERCOOLERS NORMALLY COOL AIR BY THE USE OF
ANS. FINNED TUBES, A RADIATOR TYPE, AND WATER COOLED INTERCOOLERS

69. WHAT METHOD OF LUBRICATING IS FREQUENTLY USED FOR SMALL SINGLE-ACTING RECIPROCATING COMPRESSORS
ANS. SPLASH

70. WHAT PRIME MOVERS ARE USED WHEN A COMPRESSOR USES VARIABLE SPEED CONTROL METHOD
ANS. STEAM ENGINE, STEAM TURBINE AND INTERNAL COMBUSTION ENGINE

71. WHAT TYPE OF COMPRESSOR IS USED IN A PNEUMATIC TUBE CONVEYOR
ANS. LOBE COMPRESSOR

72. WHAT IS THE PURPOSE OF AN INTERCOOLER BETWEEN COMPRESSOR STAGES
ANS. TO COOL THE AIR AS IT LEAVES THE FIRST STAGE

73. SINGLE STAGE COMPRESSORS ARE
ANS. COMPRESSORS WHICH REACH FINAL PRESSURE WITH ONE COMPRESSION STROKE

74. REASON FOR COMPRESSORS TO BE UNABLE TO REACH REQUIRED PRESSURE
ANS. AIR LEAKS OR "BLOW-BY" (PISTON RINGS), DIRTY FILTERS, AND FAULTY INTAKE AND DISCHARGE VALVES

75. SINGLE ACTING COMPRESSORS
ANS. COMPRESSES AIR ON ONE SIDE OF THE PISTON

76. STEAM TUBINE HAS STEAM TIGHT GLANDS ON
ANS. EACH SIDE OF THE WHEEL WHERE THE SHAFT GOES THROUGH THE HOUSING

77. NAME TWO CLASSES OF TURBINES
ANS. 1. REACTION 2. IMPULSE

78. HOW CAN THE CASING BE SPLIT ON A TURBINE
ANS. PARELLEL TO THE SHAFT OR AT 90(TO THE SHAFT

79. WHAT TYPE SEALANT IS USED BETWEEN CASING HALVES
ANS. SEALING PASTES OR PLASTIC STRING

80. HOW ARE SEGMENTS OF THE CARBON RING HELD TOGETHER
ANS. BY A GARTER RING

81. WHAT IS THE REASON FOR A COMPRESSOR TO BE UNABLE TO REACH REQUIRED PRESSURE
ANS. AIR LEAKS OR "BLOW BY"

CONVEYORS

1. POWERED CONVEYORS ARE USED IN PLACE OF GRAVITY CONVERYORS
ANS. WHERE MORE CONTROL MUST BE MAINTAINED OVER THE PRODUCT BEING CONVEYED AND WHERE ITEMS MUST BE MOVED OVER LONG DISTANCES WITHOUT LOSS OF HEIGHT

2. WHAT TYPE OF CONVEYOR PROVIDES THE SIMPLEST AND MOST ECONOMICAL METHOD OF TRANSPORTING GOODS
ANS GRAVITY CONVEYORS

3. ON THE "POWER AND FREE" CONVEYORS WHAT HOLDS THE POWER AND FREE TRACKS FIRMLY IN THE CORRECT POSITION WITH EACH OTHER
ANS. YOKES

4. A 458 CHAIN SHOULD HAVE
ANS. 5.8" DIAMETER CONNECTING PIN AND NOMINAL PITCH 4"

5. TO REMOVE MATERIAL AT A GIVEN POINT ON A BELT CONVEYOR USE A
ANS. PLOW AND TRIPPER

6. TRACK ELEVATORS ARE MEASURED FROM
ANS. FLOOR LINE TO THE TOP OF THE TRACK

7. WHICH ARE OSCILATING CONVEYORS
ANS. FLEXMOUNT, COILMOUNT AND TORQUEMOUNT

8. TO TRACK A BELT WHICH IS RUNNING OFF AT THE HEAD PULLY YOU SHOULD
ANS. TIGHTEN AGAINST THE SIDE RUNNING OFF

9. MAGNET PULLEYS ON BELT CONVEYORS ARE USED TO
ANS. SEPARATE FERROUS METALS

10. "LIVE" ROLLER CONVEYORS ARE
ANS. CHAIN OR BELT DRIVEN ROLLERS

11. A DRIVE IS CROWNED TO
ANS. TRACK THE BELT

12. NEW CONVEYOR BELTING SHOULD BE STORED IN
ANS. A COOL DRY LOCATION, AWAY FROM THE SUNLIGHT

13. WHAT DOES THE CARCASS OF A BELT CONSIST OF
ANS. LAYERS OF RUBBER-IMPREGNATED FABRIC OR CORD

14. HOW ARE THE BOLT HOLES MARKED OFF ON THE BELT FOR MOUNTING THE BUCKETS
ANS. STEEL SQUARE

15. MATERIAL CONVEYED TO ONE MAIN CONVEYOR IS CHANNELED BY A
ANS. FROG

16. A SCREW CONVEYOR CAN CONVEY MATERIAL
ANS. ANY DIRECTION

17. PRIOR TO WORKING ON ANY POWER CONVEYOR SYSTEM IT MUST BE
ANS. LOCKED OUT AND TAGGED

18. "SHORT PITCH" AND "HALF PITCH" SCREW CONVEYORS ARE MOSTLY USED ON
ANS. VERTICAL OR INCLINED CONVEYORS

19. WHAT IS THE MAIN PURPOSE OF SKIRT BOARDS
ANS. TO AVOID SPILLAGE

20. LAP JOINTS ARE MADE BY LAPPING THE ENDS OVER EACH OTHER FOR A DISTANCE OF
ANS. EQUAL TO THE WIDTH OF THE BELT

21. WHICH ELEVATOR IS "NOT" A BUCKET ELEVATOR
ANS. GRAVITY

22. SUPER CAVITY ELEVATORS ARE A
ANS. CONTINUOS BUCKET TYPE

23. A POSITIVE DISCHARGE ELEVATOR DISCHARGES ITS LOAD BY
ANS. A SNUB SPROCKET TO PROVIDE POSITIVE DISCHARGE

24. WHEN MEASURING A BELT THAT IS TO BE JOINED WITH A CEMENT SPLICE, ALLOWANCE MUST BE MADE FOR THE
ANS. OVERLAP

25. WHAT TYPE OF TRANSFER WOULD BE USED TO MOVE A PIECE OF SHEET METAL (LAYING FLAT) IN ANY DIRECTION HORIZONTALLY
ANS. BALL TRANSFER

26. WHAT TYPE OF BEARING IS BEST USED IN SCREW CONVEYOR HANGERS T0 ASSURE ACCURATE ALIGNMENT OF THE BEARING WITH THE AXIS OF THE CONVEYOR SCREW
ANS. SELF-ALIGNING BALL BEARING

27. A LEFT HAND SCREW CONVEYOR IS ONE WHICH
ANS. WHEN LOOKING AT THE NEAR SIDE, FLIGHTING SLOPES TO THE LEFT

28. WHEN A THRUST BEARING IS INSTALLED ON A SCREW CONVEYOR, HOW IS THE LOCATION OF THE THRUST BEARING DETERMINED
ANS. DEPENDING ON THE DIRECTION OF MATERIAL TRAVEL

29. WHAT IS THE PURPOSE OF THE "TAKE-UP"
ANS. COMPENSATOR FOR BELT WEAR OR STRETCH

30. TO TRACK A CONVEYOR BELT WHICH IS RUNNING OFF IN THE CENTRE SECTION YOU SHOULD
ANS. 1. MOVE THE SIDE OF THE IDLER THAT THE BELT IS RUNNING OFF IN THE SAME DIRECTION THE BELT IS TRAVELLING
2. SHIM THE SIDE OF THE IDLER THAT THE BELT IS RUNNING OFF

31. THE MAXIMUM TO WHICH TROUGHED BELT IDLER CAN BE ADJUSTED IS
ANS. 45 DEGREES

32. WHAT MUST BE ADJUSTED WHEN A CATON SIZE IS CHANGED ON A UNIT
ANS. PLOW SHOE, INFEED GUIDES AND OVERHEAD BELTS

33. WHEN FORMING A COMPOUND VERTICAL CURVE, THE PURPOSE OF THE STRAIGHT SECTION OF THE TRACK IS TO GAIN
ANS. THE REQUIRED ELEVATION

34. WHAT CAN BE USED TO FEED BOTTLES INTO A BOTTLE WASHING MACHINE FROM A SLAT BAND CHAIN
ANS. A SERIES OF SEPARATION PLATES AND DUPLES ROLLER CHAIN

35. WHICH CONVEYOR CHAIN BY ITS SIMPLE DESIGN PERMITS ASSEMBLY DISMANTLING WITHOUT THE USE OF TOOLS

ANS. RIVETLESS CHAIN

36. AN ACCEPTABLE METHOD USED TO DETERMINE CHAIN "SAG" ON CHAIN DRIVE EQUIPMENT IS TO COMPUTE
ANS. 4% OF THE DISTANCE BETWEEN SHAFT CENTRES

37. A BELT PULLEY IS LAGGED TO
ANS. REDUCED SLIPPAGE

38. THE PURPOSE OF LEATHER WASHERS BETWEEN THE BUCKETS AND THE
ANS. 1.ABSORB THE SHOCK AS BUCKETS PASS OVER THE PULLEY
2. HELP TO SEAL BOLT HOLES AGAINST MOISTURE

39. HOW ARE THE BUCKETS MOUNTED ON A SUPER CAPACITY ELEVATOR
ANS. END MOUNTED

40. WHY DO INDIVIDUAL ROLLER CHAIN ASSEMBLIES HAVE AN ADVANTAGE OVER OTHER ROLLER CHAIN ASSEMBLES
ANS. 1.APPROX. 180 DEGREES WRAP AROUND EACH SPROCKET
2.SUITABLE FOR REVERSING

41. TABLE DRIVES ARE DRIVEN BY
ANS. GEARS

42. HOW DOES A PNEUMATIC CONVEYOR OPERATE
ANS. A FAN

43. ON SOME PNEUMATIC CONVEYORS WHAT INTRODUCES A FIXED AMOUNT OF SOLIDS INTO THE AIR STREAM AND ALSO ACTS AS AN AIR SEAL
ANS. A SCREW FEEDER WITH ROTARY AIR LOCK

44. LAP JOINTS OF AN ELEVATOR BELT ARE MADE BY LAPPING THE ENDS OVER EACH OTHER FOR A DISTANCE EQUAL TO
ANS. THE WIDTH OF THE BELT

45. MOST CONVEYORS ARE DRIVEN AT
ANS. THE HEAD SHAFT

46. A CONVEYOR PLOW IS USED TO
ANS. UNLOAD A CONVEYOR BELT

47. WHAT IS THE FUNCTION OF FIXED TRIPPERS
ANS. WHERE MATERIAL MAY BE DISCHARGED ONLY AT FIXED POINTS

48. WHAT METHOD IS USED FOR A FAST BELT REPAIR
ANS. USE A DOUBLE-PLATE FASTENER

NOTE: IF PULLEY DIAMETERS ARE SMALL, USE A HINGED TYPE TWO-PLATE FASTENER OR MAKE THE JOINT A 45 DEGREE ANGLE AND USE STANDARD TWO-PLATE FASTENERS

49. WHAT METHOD IS USED FOR A FAST BELT REPAIR
ANS. USING DOUBLE-PLATE BELT FASTENERS

50. LAP JOINTS OF AN ELEVATOR BELT ARE MADE BY
ANS. LAPPING THE ENDS OVER EACH OTHER FOR A DISTANCE EQUAL TO THE WIDTH OF THE BELT.

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52. A CONVEYOR PLOW IS USED TO
ANS ULOAD A CONVEYOR BELT

53. WHAT IS THE FUNCTION OF FIXED TRIPPERS
ANS. WHERE MATERIAL MAY BE DISCHARGED ONLY AT FIXED POINTS

54. BELT IDLERS SHAPE OR "TROUGH" THE BELT TO
ANS. INCREASE ITS CARRYING CAPACITY

Industrial Mechanic / Millwright Study Notes and Review

DRIVES

1. THE VARIABLE OUTPUT SPEED OF A BELT TYPE VARIABLE SPEED DRIVE IS CONTROLLED WITH
ANS. ADJUSTABLE PULLY FLANGES

2. THE SHAFT BEARINGS USED TO PREVENT GREASE FROM GETTING ON THE DRIVING BELT OF A VARIABLE SPEED UNIT ARE
ANS. SEALED FOR LIFE

3. THE SIZES OF A "V" BELT ARE DESIGNATED BY NUMBERS OR LETTERD GROUPS, BUT THE ACTUAL SIZE IS DETERMINED BY ITS
ANS. CROSS-SECTIONAL AREA

4. WHEN MULTIPLE DRIVE "V" BELTS ARE MADE TO GETHER IN THE FORM OF ON COMMON BELT, THEY ARE CALLED
ANS. GROUP BELTS

5. THE CROSS-SECTIONAL AREA OF A HIGH CAPACITY "V" BELT WHEN COMPARED TO A STANDAR "V" BELT IS
ANS. SMALLER

6. TIMING BELTS ARE MADE WITH MOULDED TEETH ON THE INSIDE FACE TO PROVIDE A
ANS. POSITIVE TRANSFER OF POWER

7. UNLIKE STANDARD "V" BELTS, THE PITCH LINE OF A TIMING BELT IS LOCATED ON THE
ANS. CHORD LINE

8. BECAUSE OF THEIR MOVABLE SIDE FLANGES,SPRINGS LOADED ADJUSTED SHEAVES REQUIRE
ANS. LUBRICATION

9. BESIDES CAST-IRON, TIMING BELTS ARE MADE FROM WHAT MATERIALS
ANS. MOULDED FIBRES, PLASTIC AND ALUMINUM

10. WHAT TYPE OF SPEED CHANGE CAN BE MADE BY A MANUALLY ADJUSTABLE SHEAVE
ANS. SMALL

11. WHAT IS APPROPRIATE EFFICIENCY RATING OF A DRIVE CGAIN
ANS. 98%

12. CHAIN MANUFACTURES RATE A DRIVE CHAIN ACCORDING TO ITS
ANS. WORKING LOAD

13. THE PITCH OF A ROLLER DRIVE CHAIN IS DETERMINED BY THE
ANS. CENTRE DISTANCE OF THE CONNECTING CHAIN

14. WHAT TYPE OF SIDEBARS ARE USED FOR HEAVY DUTY FABRICATION
ANS. STRAIGHT AND OFFSET

15. A MODIFIED LEAF CHAIN THAT FORMS A TOOTH PATTERN WHEN IT IS ASSEMBLED IS A
ANS. SILENT DRIVEN CHAIN

16. WHICH DRIVE CHAIN SHOULD BE USED WHEN OPERATING IN CORROSIVE OR WET CONDITIONS

ANS. CAST CHAIN

17. SPROCKETS ARE FREQUENTLY DESCRIBED BY THE LETTERS "A", "B" AND "C". THESE LETTERS REFER TO THE
ANS. CLASS OF THE HUB

18. ALL DRIVE CHAINS HAVING OFFSET SIDEBAR CONSTRUCTION ARE FURNISHED IN
ANS. SINGLE PITCH MULTIPLES

19. IN PARRALLEL SHAFT SPEED REDUCERS THE SPLASH LUBRICATION IS AIDED BY
ANS. DAMS OR THROUGHS

20. THE OUTPUT SPEED OF A GEAR SPEED REDUCER IS DETERMINED BY THE REDUCER'S
ANS. INPUT SPEED AND RATIO

21. THE SIZE OF A SPEED REDUCER IS DETERMINED BY ITS
ANS. HORSEPOWER RATING AND GEAR RATIO

22. A GEAR SPEED REDUCER'S CONTINUOS OVERLOAD CAPACITY IS DETERMINED PRIMARILY BY
ANS. WEAR FACTORS

23. THE THRUST PRODUCED BY A REDUCER IS REDUCED BY WHICH TYPE OF GEARS
ANS. DOUBLE HELICAL

24. IN REDUCER-DRIVEN CONVEYORS AND HOISTS, REVERSE MOVEMENTS ARE PREVENTED BY
ANS. A BACKSTOP

25. HOW DOES A KISS IDLER DIFFER FROM A BACKSIDE IDLER
ANS. DOES NOR CREATE A BACK BEND OR PENETRATE THE BELT SPAN
DOES NOT CONTRIBUTE TO PERMATURE BELT FAILURE

26. THE DISTANCE FROM THE CENTRE OF ONE TOOTH TO THE CENTRE OF THE NEXT TOOTH ON THE PITCH CIRCLE IS CALLED THE
ANS. CIRCULAR PITCH

27. THE CLEARANCE BETWEEN MATING TEETH OF TWO GEARS AT THE PITCH LINE IS CALLED
ANS. BACKLASH

28. REVERSE ROTATION OF A WORM GEAR REDUCER IS PREVENTED BY THE
ANS. WORM ACTION ON THE GEAR

29. THE DISTANCE THAT ONE THREAD ADVANCES DURING ONE COMPLETE TURN OF THE WORM IS CALLED
ANS. LEAD

30. THE RADIAL DISTANCE THAT A GEAR TOOTH EXTENDS INTO THE SPACE BETWEEN TWO TEETH ON A MATING GEAR IS CALLED
ANS. WORKING DEPTH

31. THE POSITION OF THE ROLLERS IN A ROLLER TYPE VARIABLE SPEED DRIVE IS SHIFTED WITH A
ANS. RACK AND PINION DEVICE

32. WHAT IS USED WITH A SHAFT-MOUNTED REDUCER TO PREVENT IT FROM ROTATING AND

PROVIDE MEANS OF ADJUSTING "V" BELT TENSION
ANS. TIE ROD

33. ROLLER-TYPE VARIABLE SPEED DRIVES TRANSMIT MOTION THROUGH A
ANS. FRICTIONAL CONTACT

34. BEFORE INSTALLING A SHAFT MOUNTED REDUCER, THE SHAFT SHOULD BE CHECKED FOR
ANS. BENT SECTIONS, ROUNDNESS AND MISALIGNMENT

35. BEARINGS AND GEARS ON SHAFT MOUNTED REDUCERS ARE LUBRICATED BY
ANS. SPLASH

36. WHAT TYPE OF GEAR IS MOST COMMONLY USED IN SHAFT-MOUNTED REDUCERS
ANS. HELICAL

37. HOW IS TENTION MAINTAINED ON "V" BELTS WHEN USED WITH SHAFT-MOUNTED REDUCERS
ANS. TIE ROD

38. TO PROVIDE MORE REDUCTION FOR A SHAFT-MOUNTED REDUCER, WHAT IS USED
ANS. "V" BELTS

39. THE DRIVEN GEAR OF A WORM GEAR REDUCER IS USUALLY MADE OF
ANS. BRONZE

40. BOTH MECHANICAL AND ELECTRICAL PROTECTION AGAINS OVERLOADS ON THE SHAFT-MOUNTED REDUCERS IS PROVIDED BY AN
ANS. OVERLOAD RELEASE

41. TO ACCOMMODATE MISALIGNMENTS, METAL GRID COUPLINGS HAVE WHICH FEATURES
ANS. SPRING STEEL GRID

42. THE INSERTS OR CUSHIONS OF FLEXIBLE COUPLINGS ARE HELD IN POSITION BY
ANS. THE COUPLING JAWS

43. CENTRIFUGAL CLUTCHES BECOME POSITIVELY ENGAGED
ANS. AT NO TIME DURING OPERATION

44. OVER-RUNNING CLUTCHES ARE DESIGNED TO PERMIT ROTATION OF THE DRIVING FORCE
ANS. IN THE FORWARD DIRECTION ONLY

45. THE RATIO OF A WORM GEAR REDUCER IS OBTAINED BY DIVIDING THE
ANS. NUMBER OF TEETH IN THE GEAR BY THE NUMBER OF THREADS (OR STARTS) IN THE WORM

46. REASON WHY SHAFT WILL NOT TURN IN THE REDUCTION UNIT
ANS. BEARING TOO TIGHT - - - INSTALL SHIMS

47. CHANGING FROM A SMALL DIAMETER DRIVE PULLEY TO A LARGER ONE
ANS. INCREASE SPEED

48. WHAT TYPE OF CHAIN CAN BE TAKEN APART WITHOUT DISCONNECTING LINKS OR PINS
ANS. DETACHABLE CHAIN

49. WHAT DOES WEAR ON THE SIDE OF A SPOCKET AND THE INSIDE OF A CHAIN LINK MEAN

ANS. MISALIGNMENT

50. TO AVOID HAVING TO MAKE FREQUENT REPAIRS TO ROLLER CHAIN
ANS. CHANGE TO DOUBLE STRAND SAME PITCH CHAIN

51. WHAT TYPE OF GEAR DOES NOT REQUIRE THRUST BEARINGS
ANS. DOUBLE HELICAL GEARS --- HERRINGBONE GEAR

52. TYPE OF HELICAL GEARS USED ON SHAFTS THAT ARE PARALLEL
ANS. RH AND LH HELICAL

53. FOR HYPOID GEARS USE
ANS. LUBRICATING OIL OF THE E. P. TYPE (EXTREME PRESSURE) CLASS (HEAVY DUTY)

54. FLANGED COMMPRESSOR COUPLINGS ARE USED TO JOIN
ANS. SHAFTS OF EQUAL SIZE, DO NOT REQUIRE KEYS

55. THE INSERT CALLED A SPIDER IS HELD IN THE COUPLING BY THE
ANS. COUPLING JAWS

56. WHAT TYPE OF FLEXIBLE COUPLING IS USED FOR HIGH TORQUE, LOW SPEED
ANS. SLIDER COUPLING

57. IN A THREE SHAFT REDUCTION UNIT WHICH SHAFT CAN HAVE BEARING FAILURE THAT IS NOT EASILY DETECTED
ANS. INTERMEDIATE SHAFT

58. WHAT REDUCTION IS OBTAINED BY A 2 THREAD WORM DRIVING A WORM GEAR WITH 60 TEETH
ANS. 30: 1

59. THE MINIMUM AMOUNT A ROLLER CHAIN CAN BE SHORTENED IS
ANS. 1 PITCH

60. ON A FLAT BELT DRIVE WITH VARIOUS PULLEY WIDTHS, THE BELT WIDTH IS DETERMINED BY
ANS. THE NARROWEST PULLEY

61. ON A SHAFT WITH THREE SPLIT ANTI-FRICTION PILLOW BLOCKS, HOW MANY BEARINGS SHOULD BE FIXED
ANS. ONE

62. A HEAVY LOADED DRIVE HAS TO BE REPEATEDLY STARTED, MOTOR OVERLOAD IS REDUCED BY USING
ANS. CENTRIFUGAL COUPLING

63. A FRICTION CLUTCH CAN BE ENGAGED
ANS. AT ANY TIME

64. THE MECHANISM THAT CAN BE USED TO CHANGE DIRECTION OF MOTION AND INCREASE OR DECREASE FORCE OR TRAVEL IS A
ANS. BELL CRANK

65. WHAT TYPE OF GEAR IS USED ON AN ARBOR PRESS
ANS. RACK AND PINION

DRIVE FORMULA'S

1. TO KNOW BELT SPEED

ANS. (FORMULA) S = .262 X PULLEY DIAMETER (IN INCHES) X PULLEY RPM

NOTE: 3.1416 (12 = 0.2618 OR 0.262

2. TO FIND ARC OF CONTACT

A = ARC OF CONTACT
D = LARGER DIAMETER OF SHEAVE (IN INCHES)
d = SMALLER DIAMETER OF SHEAVE (IN INCHES)
C = CENTRE DISTANCE (IN FEET)

ANS. (FORMULA) A = 180(- 4.8 (D – d)
C

NOTE: 180 (3.1416 = 57.29" 57.29 (12 = 4.77' OR 4.8

3. LENGTH OF BELT (FORMULA)

STRAIGHT BELT - EQUAL PULLY

NOTE: - - - LENGTH OF BELT BETWEEN PULLEYS CAN BE APPROXIMATED BY USING THIS FORMULA.

THE DIFFERENCE OF ERROR INCREASES WITH THE VARIOUS CHANGES IN SIZES BETWEEN THE PULLEYS

L = LENGTH
D = DIAMETER IN INCHES
C = CENTRE DISTANCE IN INCHES

ANS. (FORMULA) L = 3.1416 X D + 2C

4. HOW CAN YOU SLIGHTLY INCREASE THE " ARC OF CONTACT" WITH TWO PULLEYS OF UNEQUAL DIAMETER

ANS. BY INCREASINF THE CENTRE-TO-CENTRE DISTANCE BETWEEN THE PULLEYS

RULES FOR GEARING CALCULATIONS

RPM OF DRIVEN GEAR = <u>NUMBER OF TEETH OF DRIVER X RPM OF DRIVER</u>
NUMBER OF TEETH OF DRIVEN GEAR

NUMBER OF TEETH OF DRIVEN GEAR = <u>NUMBER OF TEETH OF DRIVER X RPM OF DRIVER</u>
RPM OF DRIVEN GEAR

RPM OF DRIVEN GEAR = <u>NUMBER OF TEETH OF DRIVEN GEAR X RPM OF DRIVEN GEAR</u>
NUMBER OF TEETH OF DRIVER

NUMBER OF TEETH OF DRIVER GEAR <u>= NUMBER OF TEETH OF DRIVEN GEAR X RPM OF DRIVEN GEAR</u>
RPM OF DRIVER

GEAR RATIO = <u>NUMBER OF TEETH ON LARGER GEAR</u>
NUMBER OF TEETH ON SMALL GEAR

ROLLER CHAIN SPEED

V = VELOCITY IN FT. PER MINUTE
T = TEETH IN SPROCKET
P = PITCH IN INCHES

CHAIN SPEED IS EXPRESSED IN FEET PER MINUTE OR METERS PER MINUTE

V OR FT. PER MINUTE = RPM X T X P OR 84 X 18 X .500 = 63
12

ANS. 63 FEET PER MINUTE

CHAIN DEFINITIONS

DRIVE SPROCKET:
USUALLY, THE DRIVER SPROCKET IS THE SMALLER OF THE TWO SPROCKETS AND THE ONE HAVING THE HIGHEST R.P.M.

DRIVEN SPROCKET:
THE DRIVEN SPROCKET IS USUALLY THE LARGER OF THE SPROCKETS AND THE ONE HAVING THE SLOWER R.P.M.

CHAIN PITCH:
THIS IS THE DISTANCE (IN INCHES) FROM THE CENTRE OF ONE CONNECTING PIN TO THE CENTRE OF THE NEXT.

CENTRE DISTANCE:
THE CENTRE DISTANCE IS THE DISTANCE (IN INCHES) BETWEEN THE CENTRES OF DRIVER AND DRIVEN SHAFTS.

CHAIN LENGTH:
THE CHAIN LENGTH IS THE DISTANCE FROM CENTRE LINE OF THE CONNECTING PIN AT ONE END OF THE STRAND TO THE EMPTY CONNECTING HOLE AT THE OPPOSITE END. CHAINS CAN BE MEASURED IN FEET AND INCHES, OR IN PITCHES.

CHAIN RATING:
THE CHAIN RECOMMENDED WORKING LOAD, IS THE LOAD IN POUNDS THAT THE CHAIN WILL SATISFACTORILY HANDLE OVER EXTENDED PERIODS OF TIME. MOST MANUFACTURERS RATE THEIR CHAINS IN MAXIMUM OR AVERAGE WORKING LOAD.

ULTIMATE STRENGTH:
THIS IS THE STRENGHT OF THE CHAIN BEFORE IT WILL BREAK. THIS IS NOT A GOVERNING FACTOR IN THE SELECTION OF THE CHAIN. HOWEVER, IT GIVES YOU THE SHOCK LOADING CAPACITY OF THE CHAIN.

PITCH DIAMETER:
THIS IS THE THEORETICAL CIRCLE DESCRIBED BY THE CENTRE LINE OF THE CHAIN AS IT PASSES OVER THE SPROCKET. THE P. D. OF A SPROCKET IS USUALLY BELOW THE TOP OF THE TOOTH OR OUTSIDE DIAMETER

(O. D.) OF THE SPROCKET. ON DRIVES THAT HAVE SHORTENED TEETH (SUCH AS SILENT CHAINS) THE PITCH DIAMETER MAY BE LARGER THAN THE DIAMETER OF THE CIRCLE AT THE TOP OF THE TEETH.

STANDARD ROLLER CHAIN NUMBERS

THE RIGHT HAND FIGURE IN THE CHAIN NUMBER IS ZERO FOR ROLLER CHAINS OF THE USUAL PROPORTIONS, 1 FOR A LIGHTWEIGHT CHAIN AND 5 FOR A ROLLERLESS BUSHING CHAIN.

THE NUMBER TO THE LEFT OF THE RIGHT-HAND FIGURE DENOTES THE NUMBER IF 1/8 INCH IN THE PITCH.

THE LETTER H FOLLOWING THE CHAIN NUMBER DENOTES THE HEAVY SERIES, THUS THE NUMBER 80H DENOTES A 1 INCH PITCH HEAVY CHAIN.

THE HYPHENATED NUMBER 2 SUFFIXED TO THE CHAIN NUMBER DENOTES A DOUBLE STRAND, 3 A TRIPLE STRAND, 4 A QUADRUPLE STRAND AND SO ON.

HEAVY SERIES:

THESE CHAINS MADE IN ¾ INCH AND LARGER PITCHES HAVE THICKER LINK PLATES THAN THOSE OF THE REGULAR STANDARD.

LIGHTWEIGHT MACHINERY CHAIN:

THIS CHAIN IS DESIGNATED AS NO. 41. IT IS ½ INCH PITCH, ¼ INCH WIDE HAS 0.306 DIAMETER ROLLERS, 0.141 INCH PIN DIAMETER AND SIDE PLATES 0.050 INCH THICK, MEASURING LOAD IS 18 POUNDS.

METALLURGY

PHYSICAL PROPERTIES OF FERROUS METALS:

BRITTLENESS -IS THE PROPERTY OF A METAL WHICH PERMITS NO PERMANENT DISTORTION BEFORE BREAKING. CAST IRON, WHICH BREAKS EASILY, IS AN EXAPLE OF BRITTLE METAL.

DUCTILITY - IS THE ABILITY OF THE METAL TO BE PERMANENTLY DEFORMED WITHOUT BREAKING. METALS SUCH AS MACHINE (MILD) STEEL, WHICH MAY BE DRAWN INTO WIRE IS A DUCTILE MATERIAL.

ELASTICITY - IS THE ABILITY OF A METAL TO RETURN TO ITS ORIGINAL SHAPE AFTER ANY FORCE, ACTING UPON IT, HAS BEEN REMOVED. PROPERLY HEAT-TREATED SPRINGS ARE GOOD EXAMPLES OF ELASTIC MATERIALS.

HARDNESS -MAY BE DEFINED AS THE RESISTENCE TO FORCEABLE PENETRATION OR PLASTIC DEFORMATION.

MALLEABILTY -IS THAT PROPERTY OF A METAL, WHICH PERMITS IT TO BE HAMMERED OR ROLLED INTO OTHER SIZES AND SHAPES.

TENSILE STRENGTH - IS THE MAXIMUM AMOUNT OF PULL THAT A MATERIAL WILL WITHSTAND BEFORE BREAKING. IT IS EXPRESSED AS THE NUMBER OF POUNDS PER SQUARE INCH OF PULL THAT IS REQUIRED TO BREAK A BAR HAVING A CROSS SECTION OF ONE SQUARE INCH.

TOUGHNESS - IS THE PROPERTY OF A METAL TO WITHSTAND IMPACT OR SHOCK.

ANNEALING -ANNEALING CONSISTS OF HEATING STEEL TO ABOVE ITS CRITICAL RANGE AND THEN ALLOWING IT TO COOL SLOWLY.

NORMALIZING -IT CONSISTS OF HEATING SOMEWHAT ABOVE CRITICAL THE RANGE, FOLLOWED BY AIR-COOLING.

HARDENING -IS ACOMPLISHED BY HEATING THE STEEL BEYOND THE CRITICAL TEMPERATURE AND FOLLOWING BY RELATIVELY FAST COOLING. IF HEATING FOR HARDENING IS BEING ACCOMPLISHED IN THE FORGE FIRE THE COLOR SHOULD BE A FULL RED AND TO CHECK ON THE TEMPERATURE A MAGNET MAY BE USED, AS THE STEEL AT OR ABOVE THE CRITICAL TEMPERATURE SHOULD BE NON-MAGNETIC. IF THE MAGNET IS BEING USED WHILE THE TEMPERATURE IS BEING RAISED FROM THE ROOM TEMPERATURE, THE CORRECT POINT TO STOP HEATING IS WHERE THE STEEL NO LONGER RESPONDS TO THE PULL OF THE MAGNET. IF A FURNACE IS BEING USED TO HEAT THE STEEL TO THE HARDENING HEAT A PYROMETER AIDS GREATLY IN DETERMINING THE CRITICAL TEMPERATURE.

TEMPERING -TEMPERING IS THE APPLICATION OF HEAT AFTER HARDENING. THE PURPOSE IS TO RELIEVE SOME OF THE HARDENING STRAINS AND ALSO TO SOFTEN THE STEEL. TEMPERING IS ACCOMPLISHED BY HEATING TO SOME PREDETERMINED TEMPERATURE AND FOLLOWED BY ANY RATE OF COOLING.

1. WHAT IS MEANT BY A PLAIN CARBON STEEL
ANS. STEEL WHICH CONTAINS ONLY CARBON AND NO OTHER MAJOR ALLOY ELEMENT

2. WHAT IS MEANT BY AN ALLOY STEEL
ANS. A CARBON STEEL TO WHICH ONE OR MORE ELEMENTS ARE ADDED

3. DEFINE HEAT TREATMENT
ANS. THE HEATING AND COOLING OF STEEL TO GIVE IT SPECIFIC DESIRABLE QUALITIES.

4. MAGANESE IS BOTH ESSENTIAL AND A RESPECTED ELEMENT IN STEEL AND IS SOMETIMES CALLED
ANS. THE " TOUGHENER"

5. SCRAP STEEL, LIMESTONE AND MOLTEN PIG IRON ARE THE BASIC CHARGE FOR

ANS. OPEN HEARTH FURNACE

6. THE PRINCIPLE ALLOYING ELEMENTS CONTAINED IN STAINLESS STEEL ARE
ANS. CHROMIUM AND NICKEL

7. THE AMOUNT OF CARBON IN A PLAIN CARBON STEEL DETERMINES THAT STEEL'S
ANS. HARDNESS

8. S. A. E. 1020 STEEL CONTAINS APPROXIMATELY
ANS. .20% CARBON (0.18 – 0.23)

9. BEFORE A CARBON STEEL IS CONSIDERED HARDENABLE BY HEATING AND QUENCHING ALONE, IT SHOULD CONTAIN A MINIMUM OF
ANS. 0.35% CARBON

10. WHAT IS MEANT BY ANNEALING
ANS. HEATING STEEL TO ABOVE ITS CRITICAL RANGE AND THEN ALLOWING IT TO COOL SLOWLY.

11. WHAT IS THE OPERATION CALLED TEEMING
ANS. POURING MOLTON METAL FROM ALADLE INTO INGOT MOLDS

12. WHICH IS NOT A FERROUS METAL – COPPER, CAST IRON, STEEL OR WROUGHT IRON.
ANS. COPPER

13. PHYSICAL PROPERTIES OF FERROUS METAL ARE
ANS.
1. TOUGHNESS, HARDNESS AND BRITTLENESS
2. DUCTIBILITY AND ELASTICITY
3. TENSILE STRENGTH AND MALLEABLITY

14. WHICH OF THE FOLLOWING FERROUS METALS IS SO BRITTLE THAT IT CAN BE EASILY BROKEN
ANS. CAST IRON

15. WHAT IS HIGH CARBON STEEL
ANS. STEEL CONTAINING 0.60% MORE OF CARBON

16. DEFINE INDUCTION HEATING
ANS. A METHOD OF HEATING METAL BY MEANS OF AN INDUCTION COIL

17. DEFINE NORMALIZING STEEL
ANS. THE HEATING OF STEEL TO APPROX. 100(F ABOVE ITS CRITICAL TEMPERATURE, THEN COOLING IT IN AIR

18. WHY IS LIMESTONE USED IN A BLAST FDURNACE
ANS. TO PROVIDE A FLUX

19. DEFINE TEMPERING OF METAL
ANS. A PROCESS THAT REDUCES THE AMOUNT OF HARDNESS IN METAL BY REHEATING THE METAL BELOW THE CRITICAL TEMPERATURE.

20. DEFINE "KILLED" STEEL
ANS. STEEL FROM WHICH GAS HAS BEEN REMOVED IN THE LADLE BY THE ADDITION OF DEOXIDIZERS

21. DEFINE CASE HARDENING
ANS. A METHOD OF CREATING A HARD THIN FILM OVER THE SURFACE OF LOW CARBON STEEL

22. THE METHOD OF HARDENING LOW-CARBON STEEL BY PLACING IT IN CONTACT WITH A CARBONACEOUS MATERIAL IS CALLED
ANS. PACK HARDENING

23. THE UPPER LIMIT OR STRENGTH OF STEEL BEYONG WHICH IT WILL NOT RETURN TO ITS ORIGINAL SHAPE IS CALLED
ANS. ELASTIC LIMIT

24. THE FURNACES WHICH HAVE THEIR HEARTH OPEN TO THE FLAMES WHICH MELT THE CHARGE IS CALLED
ANS. OPEN HEARTH

25. A STANDARDIZED PROCEDURE BY WHICH THE HERDENABILITY OF A STEEL IS DETERMINED IS CALLED
ANS. JOMINY TEST

26. IDENTIFYING METALS BY OBSERVING THE SPARKS WHEN THE METAL IS HELD TO A GRINDING WHEEL IS CALLED
ANS. SPARK TEST

27. AN INSTUMENT FOR DETERMING ELEVATED TEMPERATURES IS CALLED
ANS. PYROMETER

28. IN A BLAST FURNACE THE FIRST STEP IN THE MANUFACTURING OF CAST IRON OR STEEL IS THE PRODUCTION OF
ANS. PIG IRON

29. WHICH FURNACE USES AN ELECTRODE TO MELT THE STEEL SCRAP
ANS. ELECTRIC FURNACE

30. IN A HEAT TREATMENT FURNACE, WHAT IS USED IN CONJUNCTION WITH A PYROMETER TO CONTROL THE TEMPERATURE
ANS. THERMOCOUPLE

31. WHAT IS THE CHIEF RAW MATERIAL USED TO MAKE IROM STEEL
ANS. IRON ORE

32. PLAIN CARBON STEELS CONTAIN WHAT PERCENTAGE OF CARBON
ANS. 0.80 TO 1.7

33. WHAT ARE ALLOY STEELS
ANS. STEELS OTHER ELEMENTS CONTAINING IN ADDITION TO CARGON

34 WHAT IS DONE TO STEEL TO RELIEVE STRESSES AND STRAINS
ANS. NORMALIZE

LUBRICATION

1. WHEN REFERRING TO OIL THE TERM "VISCOSITY" MEANS
ANS. THE ABILITY TO FLOW

2. MATCH THE FOLLOWING TYPES OF LUBRICANTS WITH THEIR CHARACTERISTICS

A. HYDRODYNAMIC LUBRICANT	1. THIN FILM
B. BOUNDARY LUBRICANT	2. LIGHT GREASE
C. INCOMPLETE LUBRICANT	3. THICH FILM

ANS. A - - 3 B - - 1 C - - 2

3. LOW VISCOSITY OIL IS
ANS. THIN LIKE WATER

4. WHICH IS THE SIMPLEST AUTOMATIC METHOD OF LUBRICATING ENCASED CHAIN DRIVES
ANS. SPLASH LUBRICATION

5. WHAT IS THE FUNCTION OF A LUBRICANT
ANS. TO REDUCE THE FRICTION ANS RSULTANT HEAT BETWEEN ADJACENT MACHINE PARTS WHICH MOVE IN RELATION TO EACH OTHER

6. HOW IS OIL KEPT FROM RUNNING OUT THE SHAFTS OF A GEAR BOX
ANS. BY USING AN OIL SEAL

7. PARALLEL SHAFT REDUCERS HAVING SPLASH LUBRICATION REQUIRE THE REDUCER TO HAVE
ANS. OIL TROUGHS OR DAMS

8. WHAT IS USED WITH OIL WHEN USING THE OIL MIST LUBRICATION SYSTEM
ANS. CLEAN DRY AIR

9. WHAT HAPPENS AS AN OIL OXIDIZES AND PICKS UP IMPURITIES
ANS. THE OIL TURNS A DARKER COLOUR

10. WHEN SPEAKING OF OIL WHAT IS "POUR POINT"
ANS. THE LOWEST TEMPERATURE AT WHICH OIL WILL FLOW UNDER THE INFLUENCE OF GRAVITY

11. DRIP FEED OILERS (DRIP OILERS) ARE ADVANTAGEOUS BECAUSE
ANS.
1. GIVES A VISUAL SIGHT CHECK
2. MEANS OF CONTROLLING THE FLOW OF OIL
3. CAN BE SHUT OFF WHEN THE MACHINE IS NOT IN USE

12. WHAT IS THE OLDEST METHOD OF APPLYING OIL
ANS. HAND OILER – SQUIRT CAN

13. WHAT ARE THE TWO OIL LUBRICATING SYSTEMS
ANS. ONCE TROUGH AND ENCLOSED SYSTEMS

14. THREE KINDS OF FRICTION ARE
ANS. SLIDING, ROLLING AND FLUID

15. WHICH OF THE FOLLOWING IS A MULTIGRADE OPIL
A. SAE 20
SAE 10W30
SAE 30
SAE 40
ANS. SAE 10W30

FABRICATION

1. WHICH OPPERATIONS ARE INCLUDED IN SHEET METAL DEVELOPMENTS
ANS. CUTTING AND BENDING OPERATION

2. HEMS AND JOINST ARE MADE BY WHICH OF THE FOLLOWING METHODS
ANS. BENDING THE SHEET METAL TO THE PARTS SLIP TOGETHER

3. SHEET METAL IS A FLAT METAL 12 OR MORE INCHES WIDE WITH A THICHNESS LESS THAN
ANS. 0.25"

4. SCISSOR LIKE TOOLS FOR CUTTING METAL ARE CALLED
ANS. SNIPS

5. BENDS ARE MADE WHEN FORMING SHEET METAL, OVER DIFFERENT TYPES OF STEEL ANVILS CALLED
ANS. BENCH STAKES

6. WIDE SHEETS OF SHEET STOCK IS CALLED
ANS. COILS

7. IN SHEET METAL WORKWHAT IS MENT BY THE TERM DEVILOPMENT
ANS. ALL SHAPING AND FORMING OF SHEET METAL, EXCEPT FOR STRETCHING

8. REMOVING THE BURRS AND JAGGED AREAS ON CUT SHEET METAL IS KNOWN AS
ANS. DRESSING

9. THE CURVED SLIVERS OF METAL THAT SOMETIMES REMAIN ON THE EDGE OF CUT SHEET METAL IS CALLED
ANS. FISH HOOKS

10. WHAT MATERIALS MAY THE FACE OF SOFT- FACED HAMMERS BE MADE OF
ANS. PLASTIC, COPPER AND LEAD

WELDING

1. BEFORE TURNING ON ANY CYLINDER VALVE THE
ANS. REGULATOR ADJUSTING SCREW SHOULD BE DISENGAGED

2. THE SELECTION OF THE PROPER CUTTING DEPENDS MAINLY UPON
ANS. THICKNESS OF THE STEEL TO BE CUT

3. THE FLAME ADJUSTMENT BEST SUITED FOR CUTTING MILD STEEL IS
ANS. NUTRAL FLAME

4. TO ALLOW THROUGH PENETRATION AND FUSION WHAT TYPE " V " IS NEEDED
ANS. 908 "V"

5. TWO CABLES ARE NECESSARY WHEN ARC WELDING TO
ANS. TO COMPLETE THE CIRCUIT

6. DIRECT CURRENT STRAIGHT IS OBTAINED BY
ANS. CONNECTING THR ELECTRODE TO NEGATIVE

7. FREE ACETYLENE GAS SHOULD NEVER BE USED IN EXCESS OF
ANS. 15 P.S.I.

8. THE JOINING OF TWO OR MORE PIECES OF METAL BY MELTING THEM AD CAUSING THEM TO FLOW TOGETHER IS KNOWN AS
ANS. FUSION WELDING

9. THE AVERAGE PRESSURE IN OXYGEN CYLINDERS AT 70(F IS
ANS 2200 P.S.I.

10. THE ACETYLENE REGULATOR MAY BE DISTINGUISHED FROM THE OXYGEN REGULATOR BY
ANS. THE GRUVE CUT IN THE CIRCUMFERENCE OF THE REGULATOR CONNECTING THE NUT

11. AN ACETYLENE HOSEFITTING HAS A
ANS. LEFT HAND THREAD

12. WHY IS IT BEST TO KEEP ACETYLENE CYLINDER UPWRIGHT AT ALL TIMES
ANS. IF AN ACETYLENE CYLINDER IS USED IN THE HORIZONTAL POSITION, SOLVENT MAY BE LOST AND FLAME QUALITY MAY BE AFFECTED

13. WHAT IS THE PURPOSE OF CHEMICAL COATING ON ARC WELDING ROD
ANS. 1. PROVIDES A " GASEOUS SHIELD " AROUND THE ARC WHICH PROTECTS THE MOLTEN METAL OF THE ELECTROD AGAINST OXIDIZATION IN CONTACT WITH THE OXYGEN ANDAND NITROGEN OF THE ATMOSPHERE
2. PROVIDES A MOLTEN FLUX FOR THE MOLTEN POOL, CARRIES IMPURITIES TO THE SURFACE OF THE WELD AND FORMS A PROTECTIVE SLAG WHICH INSOLATES THE WELDED JOINT AGAINST THE COOLING AFFECTOF THE ATMOSPHERE
3. IT STABELIZES THE ARC AND CONTROLS FLUIDITY OF THE METAL
4. IT TRANS MITS ALLOYING AGENTS IN ARC, TO MATCH THE BASE METAL
ELECTROD COATING AS WELL AS PROTECTING THE WELD FROM HARME FUL ELEMENTS IN THE ATMOSPHERE, HAS A GREAT EFFECT OF THE NATURE OF THE WELD WHICH IS PRODUCED

14. WHY IS "FLUX" USED FHEN BRAZING
ANS. INVISABLE OXIZEDS MAY BE DISOLVED, ALSO COMBINES WITHMETALIC IMPURITIES AND CARRIES THEM TO THE SURFACE OF THE BONDED JOINT

15. HOW IS THE PROPER WAY TO GROUND A WELDING MACHINE
ANS. SECURE AND NO CURRENT THROUGH BEARINGS

GAUGE - - - - SHEET METAL

(GAUGE NO.)	3	. 2391	(INCH THICKNESS)
	4	.2242	
	5	.2092	
	6	.1943	
	7	.1793	
	8	.1644	
	9	.1495	
	10	.1345	
	11	.1196	
	12	.1046	
	13	.0897	
	14	.0747	
	15	.0673	
	16	.0598	
	17	.0538	
	18	.0478	
	19	.0418	
	20	.0359	

REF. - - - MACHINERY’S HANDBOOK

METAL THICKNESS	TIP SIZE	OXYGEN P.S.I.	ACETYLENE P.S.I.
1/8	000	20	3
3/16	00	20	3
¼	0	30	4
3/8	0	35	4
½	1	35	4
5/8	2	40	4
¾	2	36	4
1	2	41	4
1 ¼	2	51	4
1 ½	3	42	5
2	3	47	5
2 ½	4	38	5
3	4	44	5
4	4	54	5
5	5	56	6
6	5	67	6
8	5	78	6
10	6	83	6
12	6	125	6
14	7	100	7

Industrial Mechanic / Millwright Study Notes and Review

HAND TOOLS

1. WHY IS IT BETTER TO REDRESS THE SIDES OF A SCREWDRIVER BLADE ON THR " FACE " OF THE GRINDING WHEEL
ANS. IT MAKES THE SIDES OF THE BLADE SLIGHTLY OS IT FITS THE SLOT OF THE SCREW BETTER

2. WHAT ARE VISE JAW CAPS (SOFT JAWS) SUED FOR
ANS. TO PREVENT MARKING OF THE WORK PIECE BY THE SERRATED TEETH OF THE VISE JAW

3. WHEN USING A OPEN END WRENCH – DOUBLE HEAD (DOUBLE ENDED WRENCH) HOW CAN YOU LOOSEN A NUT IN A RECTRICTED PLACE
ANS. TURN THE WRENCH OVER

4. WHEN USING A OPEN END WRENCH, WHY IS IT BEST TO PULL THE WRENCH IN THE CORRECT DIRECTION
ANS. TO AVOID SPREADING THE WRENCH OPENING

5. CHISELS AND PUNCHES ARE DANGEROUS IF THERE STRIKING FACES BECOME
ANS. MUSHROOMED

6. WHY IS IT BEST TO HAVE THE CUTTING EDGE OF A CHISLE CONVEX
ANS. TO SAVE THE CORNERS OF THE CUTTING EDGE

7. WHAT DOES A TORQUE WRENCH MESURE
ANS. RESISTANCE TO TURNING

8. WHAT PUNCH IS USED IN SHIFTING PARTS SO CORRESPONDING HOLES " LINE UP "
ANS. ALIGNING PUNCH

9. WHAT CAUSES PINNING
ANS. TOO MUCH PRESSURE ON THE FILE ESPECIALLY WHEN USING A SMOOTH FILE

10. WHEN SMALL PARTICALS OF THE MATERIAL BEING FILLED BECOMES CLOGGED IN THE TEETH OF THE FILE IT IS CALLED
ANS. PINNING

11. WHY SHOULD A HAND REAMER ALWAYS BE TURNING IN A CLOCKWISE DIRECTION
    1. NOT TO DULL THE REAMER
    2. TO ALLOW THE CUTTINGS TO ESCAPE
    3. TO HAVE AN ACCURATE SIZE HOLE
    4. THIS IS THE CUTTING DIRECTION
ANS. 1, 3 AND 4

12. WHAT IS THE LEAST NUMBER OF TEETHWHICH SHOULD CONTACT THE MATERIAL BEING SAWED
ANS. TWO TEETH

13. THE THIN SECTION BETWEEN THE FLUTES ON A DRILL GIVES RIGIDITY AND STRENGTH WHICH IS CALLED THE…
ANS. WEB

14. TOOL USED TO TIGHTEN NUTS AND BOLTS TO PROPER TORQUE
ANS. TORQUE WRENCH

Industrial Mechanic / Millwright Study Notes and Review

POWER TOOLS

1. NAME FOUR OF THE MOST ESSENTAIL PARTS OF AN ENGIN LATHE
ANS. BED, CARRAGE, HEAD STOCK, TAIL STOCK

2. THE SIZE OF THE LATHE IS DETERMINED BY
ANS. SWING AND LENGTH OF THE BED

3. CUTTING SPEED ON THE LATH IS MESURED IN
ANS. FEET PER MINUTE

4. THE TAPER ON THE LATHE TAIL STOCK SPINDIL IS A
ANS. MORSE TAPER

5. THE TOOL HOLDER RECOMMENDED FOR MACHINING WORK CLOSE TO THE LATHE CHUCK JAWS IS THE
ANS. LEFT HAND

6. THE MANDREL IS USED TO HOLD
ANS. REAMED OR BORED WORK BETWEEN THE CERTRES

7. ONE IMPORTANT ADVANTAGEOF THE RADIAL DRILLING MACHINE IS
ANS. LARGER AND HEAVER WORK MAY BE DRILLED

8. A DRILL DRIFT IS
ANS. A TAPERED WEDGE USED FOR REMOVING DRILLS

9. HOW IS THE SIZE OF THE DRILL PRESS DETERMINED
ANS. BY THE DISTANCE IN INCHES FROM THE EDGE OF THE COLUMN TO THE CENTER OF THE SPINDLE

10. KNURLING A WORKPIECE IS DONE TO
   1. PROVIDE A NON SLIP GRIP
   2. ENLARGE THE DIAMETER OF THE WORKPIECE
   3. INPROVE THE APPERANCE

ANS. ALL THE ABOVE

11. WHAT TWO ATTACHMENTS COULD BE USED ON THE LATHE TO SUPPORTA CYLINDRICAL SHAFT DURING MACHINING
ANS. STEADY REST AND FOLLOW REST

12. USING TWO SIDE MILLING CUTTERSTO MACHINE THE OPPOSITE SIDES OF A WORKPIECEPARALLEL IN ONE CUT IS CALLED
ANS. SRTADDLE MILLING

13. WHAT IS THE NAME OF THE MILLING MACHINE ATTACHMENT, WHICH CONVERTS THE ROTARY MOTION OF THE SPINDIL INTO RECIPROCATING MOTION FOR CUTTING KEYWAYS, SPLINES ETC.
ANS. SLOTTING ATTACHMENT

14. WHAT IS MENT BY " TRUING " A GRINDING WHEEL
ANS. THE OPERATION OF REMOVING ANY HIGH SPORTS ON THE WHEEL

15. WHAT IS MENT BY " DRESSING " A GRINDING WHEEL

ANS. THE OPERATION OF REMOVING THE DULL GRAINS AND METAL PARTICLES

16. WHEN TURNING A SHAFT IN A LATHE WITH TAIL STOCK OFF CENTRE
ANS. SHAFT WILL BE TAPERED

17. TO TURN DOWN A SQUARE SHAFT IN A LATHE WHAT TYPE OF CHUCK IS USED
ANS. FOUR JAW INDIPENDAN CHUCK

18. CRITICAL STAGE OF A MACHINE'S OPERATION RE – RPM IS
ANS. OPPERATING SPEED

19. WHAT IS GEAR RATIO ON A DIVIDING HEAD
ANS. 40 – 1

STANDARD TAPERS

A. MORSE TAPER: 5/8" PER FOOT RANGE IN SIZE FROM #0 TO #7 (TWIST DRILLS, REAMERS, ETC)

B. JARNO: 6" PER FOOT RANGE IN SIZE FROM #2 TO #20 (SOME VERTICAL MILLING MACHINE SPINDLES)

C. BROWN AND SHARPE TAPER 5" PER FOOT RANGE IN SIZE FROM #1 TO #18

D. STANDARD TAPER PIN ¼" PER FOOT USED FOR THE ASSEMBLY AND ALIGNMENT OF MACHINERY

E. AMERICAN STANDARD STEEP MACHINE TAPER 3 ½" PER FOOT RANGE IN SIZE FROM #5 TO #60 (#40 AND #50 TAPERS ARE SIZES USED FOR MILLING MACHINES)

NOTE: TAPERS GREATER THAN 88 ARE USUALLY REFERRED TO AS ANGLES

FASTENING TECHNIQUES

1. IF YOU HAVE A TRIPLE STAR SHREAD WITH A PITCH OF .0833, HOW FAR WILL A NUT MOVE ALONG THE SHAFTIN ONE COMPLETE REVOLUTION.

ANS. 0.2499

2. WHAT IS THE PURPOSE OF " DOWEL PINS "

ANS. FOR THE ASSEMBLY AND ALIGNMENT OF MACHINERY PARTS

3. MATCH THE FOLLOWING SCREW FASTENER DEFINITIONS
    1. 10% STRONGER
    2. FAST AND EASY ASSEMBLY
    3. EASIER TO TAP HARD MATERIALS
    4. LESS CHANCE OF CROSS THREADING
    5. USED WITH THINNER WALL THICKNESS
    6. LEAST EFFIECTED BY ABUSIVE HANDLING

ANS. COARSE THREAD --- 2,4,6.
FINE THREAD --- 1,3,5.

4. WHICH OF THE FOLLOWING KEYS REQUIRE A SPECIAL SHAPE MILLING CUTTER TO PRODUCE THE KEYSEAT

ANS. WOODRUFF KEY

5. CLASSES OF THREAD FITS 1A, 2A, AND 3A REAFER TO

ANS. EXTERNAT THREADS

6. TORQUE VALUES ARE DESIGNED TO
    1. GIVE PROPER RE LOAD ON FASTENERS
    2. CHECK THE LENGTH OF THE FASTENER
    3. CHECK THE DIAMETER OF THE FASTENER
    4. PREVENT SHEARING OF THREADS

ANS. 1 AND 4

7. WHICH OF THE FOLLOWING NEEDS A LEFT HAND THREAD

ANS. TURN BUCKEL

8. THE PIN USED FOR ALIGNMENT IS A

ANS. DOWEL PIN

9. WOODRUFF KEYS ARE DESIGNATED BY

ANS. NUMBER

10. STANDARD TAPER PINS HAVE THE FOLLOWING TAPER PER FOOT
ANS. ¼ INCH

11. THE WIDTH IS OF A SQUARE KEY IN A SHAFT SHOULD BE
ANS. ¼ THE DIAMETER OF THE SHAFT

12. GIB – HEAD TAPER KEYS HAVE A TAPER OF
ANS. 1/8" TAPER IN 12 INCHES

13. THE STRONGEST SCREW THREAD IS PRODUCED WITH
ANS. A THREAD ROLLING MACHINE

14. TENSILE STRENGTH IN EFFECT, IS DETERMINED BY MEASURING THE ABILITY TO WITHSTAND
ANS. A DIRECTLY APPLIED PULL

15. TENSILE STRENGTH IS MEASURED IN
ANS. LBS. PER SQUARE INCH

16. THE DISTANCE FROM A POINT ON A THREAD TO THE CORRESPONDING POINT ON THE NEXT THREAD IS CALLED
ANS. PITCH

THREAD TERMINOLOGY

MAJOR DIAMETER - OR OUTSIDE DIAMETER IS THE LARGEST DIAMETER OF A SCRWE THREAD OF NUT

MINOR DIAMETER – IS THE SMALLEST DIAMETER ACROSS THE BOTTOM. THIS WAS FORMERLY KNOWN AS THE ROOT DIAMETER.

INCLUDE ANGEL OF A THREAD – IS THE ANGEL BETWEEN EACH SIDE OF THE THREAD. FOR EXAMPLE, THE INCLUDED ANGEL OF A " AMERICAN NATIONAL FORM" THREAD IS 608

PITCH (P) – IS THE DISTANCE FROM ANYONE ONE POINT ON ONE THREAD TO THE CORRESPONDING POINT ON THE NEXT THREAD MEASURED ALONG THE LENGTH OF THE WORK, OR P = .1/TPI (THREAD PER INCH)

LEAD – IS THE DISTANCE THREAD ADVANCES IN ONE COMPLETE TURN ALONG ITS AXIS. FOR EXAMPLE ON A SINGEL THREAD THE LEAD IS EQUAL TO THE PITCH; ON A DOUBLE THREAD (THE THREAD WITH TWO STARTS) THE LEAD IS EQUAL TO TWICE THE PITCH

CREST – IS THE TOP OR PEAK OF EACH THREAD

ROOT – IS THE BOTTOM OF THE GROOVE OF EACH THREAD

DEPTH OF THREAD – IS THE VERTICAL DISTANCE FROM THE ROOT TO THE CREST OF THE THREAD

PITCH DIAMETER – IS THE DIAMETER OF AN IMAGINARY CYLINDER EQUAL TO HALF THE DEPTH OF THE THREAD, IT IS THE BASIC DIAMETER FOR ROLLING THREADS

HELIX ANGLE – IS THE ANGLE DEVILOPED BY THE CIRCUMFRENCE OF THE OUTSIDE DIAMETEROF THE THREAD AND THE PITCH, THE HELIX ANGLE IS REQUIRED FOR THREAD ROLLING DIES OR FOR THREAD MILLING

TOLERANCE – IS THE AMOUNT OF VARIATION PERMITED IN THE SIZE OF A PART, FOR EXAMPLE, A TOLERANCE OF .002" IMPLIES A VARIATION OF + OR - .001"

7/8 9 UN C 2 A-B

7/8= DIAMETER OF THREADS

9= NUMBER OF THREADS PER INCH
UN= UNIFIED NATIONAL FORM THREADS
C= THREAD SERIES
2= CLASS OF FIT
A-B= EXTERNAL OR INTERNAL THREADS

SCREW THREAD CLASSES TO FIT

SCREW THREAD CLASSES TO FIT HAVE BEEN ESTABLISHED FOR THE PURPOSE OF ASSURING THE MANUFACTURE OF INTERCHANGABLE SCREW THREAD PARTS.

THESE CLASSES INCLUDE 1A, 2A, AND 3A AS APPLIED TO EXTERNAL THREADS, AND 1B, 2B, AND 3B APPLIED TO INTERNAL THREADS.

THE REQUIREMENTS FOR A SCREW THREAD FITFOR SPECIAL APLICATIONS CAN BE MET BY SPECIFYING THE PROPER COMBINATION OF CLASSES FOR THE COMPONENTS. MOST REQUIREMENTS, HOWEVER, WILL BE SATISFIED BY SELECTING ONE OF THE FOLLOWING COMBINATIONS; ANY VARIATION IN THESE THREAD ELEMENTS MUST BE " DEDUCTED FROM THE PITCH DIAMETER TOLERENCE ".

CLASS 1A AND 1B --- THESE CLASSES 1A EXTERNAL AND 1B INTERNAL ARE USED ON THREDED COMPONENTS WHERE QUICK AND EASY ASSEMBLY IS NECESSARY,AND WHERE A LIBERAL ALLOWANCE IS REQUIRED TO PERMIT READY ASSEMBLY, EVEN WITH SLIGHTLY BRUISED OR DIRT – CLOGGED THREADS

CLASSES 2A AND 2B --- THESE CLASSES 2A EXTERNAL AND 2B INTERNAL, ARE DESIGNED FOR SCREWS, BOLTS, AND NUTS. THEY ARE ALSO SUITED FOR A WIDE VARIETY OF OTHER APPLICATIONS.AN ALLOWENCE IS PROVIDED WHICH MINIMIZES GALLING AND SEIZURE AS ENCOUNTERED IN ASSEMBLY AND USE. TO A LIMITED EXTENT, IT ALSO ACCOMODATES PLATING, FINISHES, OR COATINGS.

CLASSES 3A AND 3B --- THESE CLASSES 3A EXTERNAL AND 3B INTERNAL, ARE PROVIDED FOR THOSE APPLICATIONS WHERE CLOSENESS TO FIT AND ACCURACY OF LEAD ARE IMPORTANT. THESE THREADS ARE CONTAINED CONSISTANCLY ONLY THROUGH THE USE OF HIGH QUALITY PRODUCTION SUPPORTED BY A VERY EFFICIENT SYSTEM OF GAUGING AND INSPECTION.

THE PITCH DIAMETER FOR CLASSES 1, 2, ANS 3 FOR EACH STANDARD DIAMETER AND NUMBER OF THREADS PER INCH MAY BE FOUND IN MOST MECHANICAL ENGINEERING HANDBOOKS.

KEYS

1. SQUARE KEY (WIDTH IS USUALLY ¼ DIAMETER OF SHAFT)
2. GIB HEAD TAPER KEY (THIS KEY IS TAPERED)
3. PRATT AND WHITNEY KEY (ENDS ARE ROUNDED)
4. WOODRUFF KEY (SEMICIRCULAR IN SHAPE)

KEY SEAT -- IS MACHINED IN THE SHAFT.
KEYWAY – IS MACHINED IN THE HUB.

BLUEPRINT

1. A BLUE PRINT WITH 3 VIEWS IS CALLED

ANS. ORTHOGRAPHIC

2. THE PURPOSE OF A AUXILARY VIEW IS TO SHOW

ANS. THE TRUE SHAPE AND SIZE OF AN INCLINED SURFACE

3. THE LOCATION OF AN AUXILIARY VIEW IS PLOTTED BY USING
ANS. PROJECTION LINES

4. WHAT IS THE CUTTING PLANE LINE
ANS. AN IMAGINARY LINE

5. WHAT ARE PHANTOM LINES
ANS. 1. LINES USED TO INDICATE THE ALTERNATE POSITIONOF A PART
2. LINES WHICH SHOW THE POSITION OF THE ADJOINING PART

6. THE MOST PROMINENT LINE ON A DRAWING SHOULD BE
ANS. THE OBJECT LINE

7. WHAT IS MENT BY ALPHABET OF LINES
ANS. IT MEANS THE SAME IN DRAWINGS AS LETTERS MEAN TO WORDS

8. A CIRCLE DRAWN IN " ISOMETRIC " APPEARS AS AN
ANS. ELLIPSE

9. A STRIGHT LINE GOINING ANY TWO POINTS ON THE CIRCUMFRENCE OF A CIRCLE IS CALLED A/AN
ANS. CHORD

10. A LINE THAT TOUCHES BUT DOES NOT CUT THE CIRCUMFRENCE OF A CIRCLE IS CALLED A
ANS. TANGENT

11. THE AMOUNT OF VARIATION ALLOWED ON A DIMENTION IS CALLED THE
ANS. TOLERANCE

12. WHAT IS A " BOLT CIRCLE "
ANS. A CIRCULAR CENTER LINE

13. WHAT IS MENT WHEN IS TI STATED THAT AN OBJECT IS DRAWN TO SCALE
ANS. TO PREPARE VIEWS OF IT TO A SIZE THAT IS DIRECTLY PROPORTIONAL TO IT'S ACTUAL SIZE

14. THE TOTAL NUMBER OF DEGREES IN ANY TRIANGLE IS
ANS. 1808

15.EACH PART OF A CIRCLE WHICH IS DIVIDED INTO 12 PARTS IS EQUAL TO
ANS. 308

MEASUREMENT

1. A LARGE CIRCLE MAY BE MADE WITH A TOOL CALLED
ANS. TRAMMEL

2. THE DIVISIONS ON A STEEL RULE ARE CALLED
ANS. GRADUATIONS

3. THE DIVICE THAT COMPRESSES THREE INTERCHANGEABLE TOOS (SQUARE , CENTER HEAD, AND PROTRACTOR) IS
ANS. COMBINATION SET

4. WHAT IS THE DIFFERENCE BETWEEN A SCALE AND A RULE
1. A SCALE IS GRADUATED IN PROPORTION TO A UNIT OF LENGTH

2. THE MACHINIST'S STEEL RULE, THE GRADUATIONS REPRESENTE FULL SIZE INCHES
3. BOTH CAN BE MAD FROM THE SAME TYPE OF METAL

ANS. ALL OF THE ABOVE

5. WHICH OF THE FOLLOWING ARE SOURCES OF MEASUREMENT ERROR
   1. INHERENT INSTRUMENT ERROR
   2. OBSERVATIONAL ERROR
   3. MAINPULATIVE ERROR
   4. BIAS

ANS. ALL THE ABOVE

6. WHAT IS THE REFERENCE POINT

ANS. STARTING POINT

7. WHAT IS THE MEASURED POINT

ANS. THE POINT WHERETHE CORRECT MEASUREMENT SHOWS ON THE STEEL RULE

8. "FEELER" GAUGES ARE FOR THE PURPOSE OF

ANS. CHECKING CLEARENCES BETWEEN TWO SURFACES IN THOUSANDTHS OF AN INCH

9. THE FLEXABLE STEEL RULE IS PARTICULARY USEFULL IN MEASURING

ANS. CURVED SURFACES

10. TO ENSURE A DIAMETER WILL BE MEASURED CORRECTLY WHEN A CALIPER IS USED, THE CALAPER SHOULD BE

ANS. SLIPED OVER WITH A DELICAT TOUCH

11. ALL MEASUREMENT REQUIRES WHICH OF THE FOLLOWING
   1. THE PART
   2. THE MEASUREING DEVICE
   3. THE STANDARD

ANS. ALL THE ABOVE

12. A TOOL THAT CAN BE USED TO MAKE ACCURATE MEASUREMENTS BUT MUST BE USED WITH A MICRO METER

ANS. TELESCOPING GAUGE

13. THE VERNIER CALIPER HAS AN ADVANRAGE OVER THE VERNER MICROMETER IN THAT IT

ANS. CAN BE USED TO MAKE BOTH INSIDE AND OUTSIDE MEASUREMENTS OVER THE RANGE OF SIZE

14. STRIGHTEDGES ARE USED TO
   1. CHECH SURFACES FOR FLATNESS
   2. ACT AS A GUIDE WHEN SCRIBING LONG, STRIGHT LINES IN LAYOUT WORK
   3. LINE UP PULLIES, SHEAVES ETC.

ANS. ALL THE ABOVE

15. PRECISION MEASURING TOOLS ARE DIVIDED INTO CATEGORIES WHICH ARE
   1. FOR OUTSIDE MEASUREMENT
   2. FOR INSIDE MEASUREMENT
   3. FOR DEPTH MEASUREMENT
   4. FOR THREAD MEASUREMENT

ANS. ALL THE ABOVE

16. A VERNIER GUAGE WEIGHT IS ALWAYS USED WITH A
ANS. SURFACE PLATE OR AN ACCURAT FLAT SURFACE

17. A SMALL HOLE GUAGE MEASURES BY
ANS. USING A TAPERED PLUNGER WHICH IS DRAWN UP BY THE SCEW CAUSING THE TWO HALVES OF THE BALL TO OPEN UP AND CONTACT THE HOLE

18. THE VERNIER CALIPER CAN MEASURE TO WHAT PART OF AN INCH
ANS. 0.001

19. WHAT IS AN OFFSET SCRIBER
ANS. A VERNIER WEIGHT GUAGE ATTACHMENT WHICH PERMITS THE SETING OF WEIGHTS FROM THE FACE OF THE SURFACE PLATE

20. WHEN READING THE GRADUATIONS OF A MICROMETER DEPTH GUAGE, HOW ARE THEY COMPAIRED TO A STANDARD MICROMETER
ANS. THEY ARE REVERSED

LAYOUT

1. TRAMMELS ARE USED TO SCRIBE
ANS. LARGE ARCS

2. A CENTER HEAD OF A COMBINATION SQUARE CAN BE USED IN LAYOUT
ANS. TO LOCATE CENTER OF ROUND WORK

3. NAME THREE DIFFERENT MATERIALS THAT SURFACE PLATES ARE MADE OF
ANS. CERAMIC, CAST IRON AND GRANITE

4. LAYOUT IS THE ERM APPLIED TO
ANS. TRANSFER OF LINES AND DEMENTIONS TO THE WORKPIECE

5. BEFORE A MACHINED SURFACE IS TO HAVE LAYOUT WORK PERFORMED ON IT, IT SHOULD BE
ANS. CLEANED AND DEGREASED

6. IN THE PROCESS OF LAYING OUT, FINE ADJUSTMENTS IN POSITIONING A WORK PIECE ON A SURFACE PLATE SHOULD BEST BE DONE WITH
ANS. SMALL JACKS

7. THE SQUARE HEAD ON A COMBINATION SQUARE CAN BE USED TO LAY OUT
ANS. A 458 ANGLE

8. NAME TWO SUBSTANCES WHICH IS USED ON ROUGH CASTINGS AND TO SHOW UP THE SCRIBED LINES
ANS. (1) CHALK AND (2) A MIXTURE OF LIME AND ALCOHOL

9. TO MAKE LAY OUT LINES EASIER TO SEE ON THE SHINY FLASH OF METAL WE CAN USE.
ANS. LAYOUT DYE (BLUING)

10. THE BEST METHOD OF SCRIBING ARCS FROM AN EXISTING HOLE WOULD BE TO USE
ANS. A FALSE CENTRE

FORMULA FOR CEMENT

MIX;

1 PART CEMENT
2 PARTS SAND
2 ½ PARTS STONE (¾" MAX)
ADD WATER AS REQUIRED

NOTE TO FIND THE NUMBER OF CU. YDS. OF CONCRETE NEEDED – MULTIPLY THE NUMBER OF SQUARE FEET BY THE BEPTH IN INCHES THEN DIVIDE THE RESULT BY 324 (L X W X D 4 324)

EXAMPLE: 9 FT. X 18 FT. PATIO 4 IN. DEEP

9 X 18 = 162 SQ. FT. X 4 IN. DEEP = 648

AND DIVIDE BY 324 = 2 CU. YDS OF CONCRETE
OR
9 X 18 X 4/12 X1/27 = 2 CU. YDS. CONCRETE

BASIC STEPS OF LIFTING AND HANDLING

SIZE UP THE LOAD AND CHEQUE OVERALL CONDITIONS. DO NOT ATTEMPT TO LIFT ALONE IF THE OBJECT APPEARS TOO HEAVY, OR AKWARD. CHEQUE ADICUATE SPACE FOR MOVEMENT AND GOOD FOOTING

LOOK FOR SLIVERS, NAILS, AND SHARPE ENDS ETC. WHEN HANDELING MATERIALS OR PACKAGES, IF POSSIBLE REMOVE THEM

MAKE CERTAIN OF GOOD BALANCE. FEET SHOULDER WIDTH APART; ONE FOOT BESIDE AND ONE FOOT BEHIND THE ARTICLE TO BE LIFTED.

BEND THE KNEES, DO NOT STOOP. KEEP THE BACK STRAIGHT, NOT VERTICAL; THERE IS A DIFFERENCE. TUCKING IN THE CHIN TO MAKE CERTAIN THE BACK IS STRAIGHT

GRIP THE LOAD WITH PALMS OF THE HANDS AND THE FINGERS. THE PALM GRIP IS MUCH MORE SECURE. WITH GRIP TAKEN, TUCK IN THE CHIN TO MAKE SURE THE BACK IS STRAIGHT

USE BODY WEIGHT TO START THE LOAD MOVING AND THEN LIFT BY PUSHING UP WITH THE LEGS, MAKING FULL USE OF THE STRONGEST SET OF MUSCLES.

METRIC SYSTEM

THE FOLLOWING IS THE STANDARD TABLE OF PREFIXES USED IN THE METRIC SYSTEM. THE UNIT MEANING – METER, LITER, GRAM. ETC.

MEGA	1,000,000 TIMES THE UNIT
HACTOKILO	1000,000 TIMES THE UNIT
MYRIA	10,000 TIMES THE UNIT
KILO	1,000 TIMES THE UNIT
HECTO	100 TIMES THE UNIT
DECA	10 TIMES THE UNIT
UNIT	1 TIMES THE UNIT
DECI	1/10 UNIT
CENTI	1/100 UNIT
MILLI	1/1000 UNIT
DECIMILLI	1/10,000 UNIT
CENTIMILLI	1/100,000 UNIT
MICRO	1/1,000,000 UNIT

LENGTH

10 MILLIMETERS	1 CENTIMETER
10 CENTIMETERS	1DECIMETER
10 DECIMETERS	1 METER
10 METERS	1 DECAMETER
10 DECAMETERS	1HECTOMETER
10 HECTOMETERS	1KILOMETER

WEIGHT

10 MILLIGRAMS	1 CENTIGRAM
10 CENTIGRAMS	1 DECIGRAM
10 DECIGRAMS	1 GRAM
10 GRAMS	1 DECAGRAM
10DECAGRAMS	1 HECTOGRAM
10 HECTOGRAMS	1 KILOGRAM
1,000 KILOGRAMS	1 METRIC TON

FLUID

10 MILLILITERS	1 CENTILITER
10 CENTILITERS	1 DECILITER
10 DECILITERS	1 LITER
10 LITERS	1DECALEITERS
10 DECILITERS	1HECTOLEITER
10 HECTOLITERS	1 KILOLEITER

COMBINATION SET

COMBINATION SET – CONSISTS OF A STEEL RULE, SQUARE HEAD, CENTER HEAD AND PROTRACTOR

THE STEEL RULE – OR BLADE IS MARKED IN 1/8, 1/16, 1/32 ANS 1/64. IT IS A VERY GOOD AND USEFUL MEASURING TOOL BUT ONLY ACCURATE TO 1/64 OF AN INCH. THE SAME APPLIES IF YOU ARE MEASURING OVER THE LENGTH OF THE RULE. EG, IF YOU ARE MEASURING A 4 FT, SHAFT YOU WOULD NOT PLACE THE 12 INCH RULE ON THE SHAFT AND MARKE OFF 12 INCHES, THEN MARK OFF 24 INCHES. ETC. WHAT YOU WOULD USE IS A RULE THAT WOULD BE FOUR FEET OR OVER.

SQUARE HEAD – SLIDES ON THE STEEL RULE AND CAN BE POSITIONED AS REQUIRED. THE SQUARE HEAD HAS AN ACCURATLY GROUND 90(FACE PLUS A 45(MITER FACE. THERE IS A SPIRIT LEVEL INCORPORATED IN THE HEAD WHICH IS VERY USEFULL IN LEVELING.

PROTRACTOR HEAD – SLIDES ON THE STEEL RULE. MOST PROTRACTOR HEADS WILL TURN FROM 0(TO 180(IN OPPOSITE DIRECTIONS. THIS IS A VERY GOOD TOOL FOR CHECKING AND MARKING OFF THE ANGLE DESIRED.

CENTER HEAD – THIS HEAD ALSO SLIDES ON THE STEEL RULE AND IS USED FOR MARKING OF SHAFTS ETC.

MULTIPLIERS THAT ARE USEFULL TO THE TRADE

TO CHANGE TO	MULTIPLY BY
INCHES TO FEET	0.0833
INCHES TO MILLIMETERS	25.4
FEET TO INCHES	12
FEET TO YARDS	0.3333
YARDS TO FEET	3
SQUARE INCHES TO SQUARE FEET	0.00694
SQUARE FEET TO SQUARE INCHES	144
SQUARE FEET TO SQUARE YARD	0.11111
SQUARE YARD TO SQUARE FEET	9
CUBIC INCHES TO CUDIC FEET	O.OOO58
CUBIC FEET TO CUBIC INCHES	1729
CUBIC FEET TO CUBIC YARDS	0.03703
CUBIC YARDS TO CUBIC FEET	27
CUBIC INCHES TO GALLONS	231
GALLONS TO CUBIC FEET	0.1337
POUNDS OF WATER TO GALLONS	0.12004
OUNCES TO POUNDS	0.0625
POUNDS TO OUNCES	16
INCHES OF WATER TO POUNDS PER SQUARE INCH	0.0361
INCHES OF WATER TO INCHES OF MERCURY	0.0735
INCHES OF WATER TO OUNCES PER SQUARE INCH	0.578
INCHES OF WATER TO POUNDS PER SQUARE FOOT	5.2
INCHES OF MERCURY TO INCHES OF WATER	13.6
INCHES OF MERCURY TO FEET OF WATER	1.1333
INCHES OF MERCURY TO POUNDS PER SQUARE INCH0	.4914
OUNCES PER SQUARE INCH TO INCHES OF MERCURY	0.127
OUNCES PER SQUARE INCH TO INCHES OF WATER	1.733
POUNDS PER SQUARE INCH INCHES OF WATER	27.72
POUNDS PER SQUARE INCH FEET OF WATER	2.310
POUNDS PER SQUARE TO INCHES OF MERCURY	2.04
POUNDS PER SQUARE INCH TO ATMOSPHERE	0.0681
FEET OF WATER TO POUNDS PER SQUARE INCH	0.434
FEET OF WATER TO POUNDS PER SQUARE FEET	62.5
FEET OF WATER TO INCHES OF MERCURY	0.8824
ATMOSPHERE TO POUNDS PER SQUARE INCH	14.696
ATMOSPHERE TO INCHES OF MERCURY	29.92
ATMOSPHERE TO FEET OF WATER	34
LONG TONS TO POUNDS	2240
SHORT TONS TO POUNDS	2000
SHORT TONS TO LONG TONS	0.89285